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GEOGRAPHY OF HUNGER

by

JOSUÉ DE CASTRO

With a Foreword by
LORD BOYD ORR

CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE, * MYSORE. *
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FOREWORD

THE TITLE OF this brilliantly written book might well have been "Hunger and Politics" because from the discussions there emerge political issues of the first magnitude. But as the author points out it is considered rather indecent for well-fed people to discuss the hunger of those who are less fortunate, and it has never been a popular subject in politics. Yet hunger has been from time to time the most dangerous force in politics. It was hunger which precipitated the French Revolution. A mob of women from the slums of Paris marched to the Parliament House demanding bread. The politicians fled. The women joined by the men then marched to the Bastille. The fall of the Bastille was the death knell of the Feudal System in France, and the beginning of a new era in European politics. The revolutionary movement in the "hungry forties" of the nineteenth century was due to the same cause. The Chartist mob in England cried "bread or blood". With the free import of cheap food the revolutionary spirit in England evaporated. Today it is now rather tardily beginning to be recognized that hunger, the worst evil of poverty, is the fundamental cause of the revolt of the Asiatics against economic domination by European powers—a revolt which cannot be stopped by guns so long as these people believe that their hunger and poverty are unnecessary evils. In the present crisis this book is vitally important. If politicians of all countries could have a short truce from political conflict and read it with unprejudiced minds there would be a saner outlook on world affairs and a better chance of saving our civilization from perishing in a third world war.

The term "hunger" used by the author needs to be defined. In the past it was used to mean lack of food to satisfy appetite and the number of deaths from hunger limited to the emaciated people, who died from sheer starvation as in famine. The author, however, uses it in the modern sense as lack of any of the forty or so food constituents needed to maintain health. The lack of any of these causes premature death though not necessarily from emaciation due to lack of any kind of food that can be eaten. Lack of any kind of food as occurs in famine has always been a major cause of death. Even in recent times more people have died from famine than have been killed in war. But these numbers are small when compared with the number whose diet is inadequate to maintain health and who consequently suffer to some degree from nutritional diseases. If hunger be used in this sense then according to the best pre-war estimates two-thirds of the population of the world are hungry. A recent American Committee put the number as high as 85 per cent.

To provide sufficient food for all mankind, taking account of the anticipated increase in population, it would be necessary to about double world food production in the next twenty-five years. Milton Eisenhower who is as distinguished and as great an authority in his own sphere as his brother the General is in war, estimates that an increase of 110 per cent would be needed.

This raises the question whether the earth can provide sufficient food for the rapidly increasing population. The neo-Malthusians believe that it is impossible, and that the only road to the survival of western civilization is birth control, rigorously imposed if necessary, to reduce the population. The author, however, points out, as is well known, that the birth rate is highest among the ill fed and lowest among the well fed where indeed it falls to or below replacement level in spite of an ever-decreasing death rate. He offers a physiological explanation for this difference based on experiments on animals. A high protein intake leads to a high percentage of cases of sterility. The birth rate falls as the consumption of the protein rich foods, e.g. meat, eggs, milk, increases. As these are the expensive foods, consumption is in proportion to wealth. . . . He gives a list of countries of the world with protein intake and birth rate beginning with Formosa with an average intake of 4·7 grams per head per day, and a birth rate of 45·6 and a regular correlation between protein intake and birth rate down the list to Sweden with an intake of 62·6 and a birth rate of 15.

There are, of course, economic and cultural factors apart from diet which affect birth rate. There is, however, little doubt that the only real effective method of birth control is to improve the diet, to raise the standard of living and education of the nations with the high birth rate to that of those where the birth rate, once as high as that of any nation, has fallen to or below the replacement level. That, however, will be a slow process. There is little doubt that unless there is a war with biological weapons of death, which are said to be able to kill off more than 50 per cent of the population of any area where they are used, the pre-war population of about 2,000 millions will within the lifetime of our children be between 3,000 and 4,000 millions.

Can the earth provide food on a health standard for this increased number? The author gives well-authenticated facts to show that there is no physical difficulty in doubling or redoubling the world food supply. If the farmers fail us, the chemist has already shown the way to synthetic food. The only practical limitations to food production are the amount of capital and labour human society is willing to devote to it.

The question is are governments willing to co-operate in a world food plan? Such a plan as the only means of fulfilling the promise of freedom from want, though welcomed by most governments, was rejected by the U.S.A., the U.K. and the U.S.S.R. Governments are prepared to unite men and resources for a world war but the Great Powers are not prepared to unite to banish hunger and poverty from the world. The reason for this reluctance to apply modern science for the benefit of all mankind, beginning with the poorest, is brought out in this book. The story of the economic domination of the earth, and the exploitation of the people and natural resources of weak nations by western European nations in the last three hundred years and since the Spanish American war by the United States, here set forth fully documented, is a shock to anyone with preconceived ideas of the glories and virtues of our western civilisation. It is a story of a ruthless fight for wealth with little regard for the rights or welfare of "inferior races".

But in the last hundred years the rather brutal mercantile age fighting for profits at whatever expense to their fellow men has been with increasing rapidity changing to a social age in which both political and economic freedom are beginning to be regarded as the inalienable rights of every human being. If, by some miracle, there would be an absolute guarantee that there would be no war for fifty years the next generation would see human society well on the way to a world of peace and plenty with hunger, poverty, and preventable disease which have always afflicted the majority of mankind banished forever from the earth.

As the author points out this might be the common ground on which the two new great powers and their satellites which divide the world, might meet. Both declare that their object is to benefit all mankind. Both declare their passionate desire for peace. Why not begin to get together and consider co-operating in a concrete plan to increase the wealth of the world to provide the primary necessities ot life, beginning with food, for the people of all nations? As President Truman once said, if we could discuss with Russia our common interest in agriculture it would be easier to discuss political differences. Why not put on the agenda for a meeting of Foreign Ministers co-operation through the United Nations Agencies in a world food plan which would be of much more interest to 99 per cent of people than interminable discussions on political ideologies?

Boyd Orr.

ACKNOWLEDGMENTS

In order to get accurate information on the actual living conditions of the world's peoples, I have conducted a widespread correspondence, during the years that this book has been in preparation, with experts and scholars from many countries. In the same way, I have travelled extensively on three continents in order to contact and talk with strategically placed personalities who were in a position to give authoritative testimony on the subject.

The abundant material so obtained, all the way from articles, books, and official publications to unpublished reports and oral opinions, has contributed greatly to the attainment of my purpose: a study of the phenomenon of hunger in its universal manifestations. I should therefore like to express my most sincere thanks to all those who have been so kind as to provide the necessary information, and thus enable me to complete the task.

I also wish to express special thanks to my friends Sanford Greenburger and Theodore Jaeckel of New York, who took a lively interest in this book when it was still in the project stage, and contributed many suggestions that have helped to give it its final form. I am also grateful to the writers George Reed and G. Robert Stange for their efficient and devoted work in the preparation of the English translation.

And finally, to my eminent friend, the English scientist Lord Boyd Orr, whose life and work constitute a symbol of human dignity and greatness, I wish to set forth my gratitude for the exceptional honour he has done me in writing the Foreword to this book.

J. C.

Instituto de Nutricao,
Universidade do Brasil,
Rio de Janeiro, Brasil.

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PART I

CHAPTER I

THE TABOO OF HUNGER

THE "Geography of Hunger" may well strike the reader as a strange expression. For geography, in the usual sense of the word, has always dealt more with the positive and favourable aspects of the world than with its negative and unfavourable side. Geographers have studied the wealth of the earth and the victories of man rather than his deprivations and failures. In our own time the science of "human geography" has set out to write the epic of human toil, to describe its brilliant results as they are registered on the surface of the earth, and to record everything that man, as a geographic factor, has done to alter his natural environment. The "Geography of Hunger" takes up a different aspect of the relations between man and nature. It deals with precisely those things that man has not done, with the tasks for which he lacked either the knowledge or the will. It explores the geographical possibilities of which he has not taken advantage, and the opportunities he has wasted. This, then, is a geography, not of human accomplishment, but of human poverty and distress.

We are now at a stage in the evolution of geographical knowledge when an accounting can be made of the mutual relations between the earth and its human inhabitants. In the light of contemporary science the balance sheet shows substantial entries to man's credit. His hard work in dominating the forces of nature has produced results. But it also shows that all in all man has taken out much more than he has put in, and he remains in debt. The plague of universal hunger, that prevailing social calamity of our day, is a characteristic result of this debt: man's deficit in his enterprise of colonizing the world.

If students and scientists would draw up balance sheets of this sort, full of the sober eloquence of facts and figures, they might influence the human race to change its social behaviour. And, as a result, future humanity might be able to render an account of its administration of the planet which would look better to the eyes of generations to come.

I

The history of man from the beginning has been the history of his struggle for daily bread. It is very difficult to understand how this pretentiously superior animal, this lord and master of the universe who has won so many battles against the forces of nature, should have failed to obtain a decisive victory in his struggle for subsistence. For we know from scientific observation that even today, after some hundreds of thousands of years of striving, two-thirds of the world's population live in a permanent state of hunger. A billion and a half human beings can still not find the means of escaping this most terrible affliction of society.

Is it possible to consider hunger as a phenomenon inherent in life itself, a natural and inevitable contingency like death, or should it be regarded as a social evil, a plague of man's own making? It is with this dangerous and delicate question that my book will deal. Because of its explosive political and social implications, the subject until very recently has been one of the taboos of our civilization. It has been our highly vulnerable Achilles heel, a subject which could not safely be discussed in public. Like sex, hunger was shameful, indecent, unclean. It was made untouchable, taboo.

Buddha, in antiquity, said that "hunger and love constitute the germ of all human history", and much later Schiller observed that "hunger and love rule the world". Nevertheless, very little has ever been written about the phenomenon of hunger. The number of books on the subject in any language is shockingly scanty—especially in view of the abundant literature on matters of obviously secondary social importance. What are the hidden motives that have led our culture to abstain from dealing with the problem of hunger, from trying to get at the root of it? It is strange to find that its narrow aspects of sensation, what Spinoza called the impulse and instinct that has served as the motive force of human evolution, have been ignored; but it is even more curious to observe the oppressive silence that has surrounded its broader influence as a universal calamity.

The disparity is most surprising when we compare the case of hunger with the other calamities that have repeatedly devastated the world, with, for example, wars and epidemics. It then becomes painfully clear that it is hunger which is least studied and discussed, least understood in its causes and effects. For each study of the problems of hunger there are over a thousand publications on the problems of war. A ratio of more than a thousand to one! Yet, as this book will abundantly demonstrate, the human waste resulting from hunger is considerably greater than that from wars and epidemics put together. The damage has been more extensive in the number of victims, and a great deal more serious in its biological and social consequences. In the last century the German scientist Waser pointed out that the loss of life brought about by the plague or by war was usually made up in an average period of ten years, while the survivors of great famines were broken for the rest of their lives. But to dissipate any remaining doubts as to the unquestionable leadership of hunger's destructive powers, it is sufficient to emphasize the universally recognized fact that hunger has been the most common and effective cause of war and that it has been the advance agent which prepared the ground for the outbreak of the great epidemics.

Hunger, then, has unquestionably been the most potent source of social misfortunes, but our civilization has kept its eyes averted, afraid to face the sad reality. War has always been loudly discussed. Hymns and poems have been written to celebrate its glorious virtues as an agent of selection. In this civilization of ours, which began mercantilist and ended militarist, an attempt was even made to demonstrate by scientific theory that the existence of war was necessary and in accord with the natural law of life. Thus, while war became a *leitmotiv* of western thought, hunger remained only a vulgar sensation, the repercussions of which were not supposed to emerge from the realm of the subconscious. The conscious mind, with ostentatious disdain, denied its existence.

2

There were several motives for this conspiracy of silence. First, there was the question of morality; the phenomenon of hunger, whether hunger for food or sexual hunger, is a primary instinct, and there was something shocking about this to a rationalist culture which tried by all possible means to make reason dominate instinct in human conduct. Instinct was held to be animal, while reason alone had social value, and our civilization attempted systematically, though unsuccessfully, to deny the creative power of instinct, treating it as low and indecent.

Since the end of the eighteenth century western culture, with its encyclopaedists and idealist philosophers, has put forward a concept of man and his behaviour which renders him virtually angelic—a being who, from cannibal beginnings, soared on wings of culture to the purest intellectualism, free of animal impulses. But in reality each arrogant optimist of that infatuated nineteenth century, as he spoke of man's magnificent rise and his perfection, felt the indiscreet needling, in his most intimate being, of hunger and sexual desire, the remnants of his primitive bestiality. These cultural idealists thought that they could master the impulses by hiding and smothering them; European civilization made it a point not to mention these subjects. "And for a whole century, an extremely long century," said Stefan Zweig, "this cowardly moral conspiracy of silence dominated Europe." Until one day a genius, inconveniently and providentially, broke the oppressive quiet.

To the pretended astonishment of official science and contemporary morality, Sigmund Freud declared sex to be a force so intense that it extends to, and indeed dominates, the consciousness. Man, before everything else, is sex. This view of mankind was not entirely surprising, but it was inconvenient. Each of Freud's learned colleagues had felt the conflict of sexual instincts in himself, like a hidden abscess he dared not lance publicly for fear of revealing the pus. Freud broke open the abscess. Singlehanded, with opposition and disapproval on all sides, he carried out the life-saving operation. Since then, it has been possible to speak of sex in a voice above a whisper.

3

There were reasons even stronger than prejudice, reasons rooted in the shrouded world of economic interest, for suppressing discussion of hunger. Dominant and privileged minorities used their deftest sleight-of-hand to keep the question of hunger from the attention of the modern spirit. It was to the advantage of economic imperialism and international commerce, both controlled by profit-seeking minorities, that the production, distribution and consumption of food products be regarded as purely business matters rather than as phenomena of the highest importance to society as a whole.

The world's geography expanded in the sixteenth century, and colonial economies followed the extending horizon, raising European civilization toward its zenith of splendour. In the seemingly fine world of imperial Europe there was no place for ugly revelations of starvation, particularly since hunger, too, was a product of the colonial system. Hunger has been chiefly created by the inhuman exploitation of colonial riches by the latifundia and one-crop culture which lay waste the colony, so that the exploiting country can take too cheaply the raw materials its prosperous industrial economy requires. For economic reasons misery was hidden from the world's eyes; tragedies like that of China, where in the nineteenth century some 100 million individuals starved to death, or like that of India, where 20 million people died of hunger in the last thirty years of the century, were glossed over.

Western literature, inheriting western culture, bent to its interests and blinded by its splendour, was an accomplice in its silence. A very few authors dared break the taboo and communicate their dark visions of the subterranean world of starvation and suffering: Knut Hamsun in his masterly novel, *Hunger*, giving a detailed report of the confused and contradictory sensations produced by his own hunger; Panait Istrati, wandering famished across the glimmering plains of Rumania; Felekov and Alexander Neverov, describing dramatically the intense black hunger of Russia in convulsion;

George Fink, starving in the grey and sordid suburbs of Berlin; and John Steinbeck telling, in *The Grapes of Wrath*, the story of the Joad family's epic journey of hunger across the richest lands of the richest country in the world. These and a few others were voices crying in a wilderness of indifference.

Western science and technique, brilliantly victorious over the forces of nature, failed almost entirely to do battle with hunger. The scientists kept a pointed silence about the living conditions of the world's hungry masses; consciously or unconsciously, they became accomplices in the conspiracy. The social reality of hunger stayed outside their laboratory walls.

Science, then, was catastrophically unprepared for the Allied liberation of the Nazi concentration camps. On April 12, 1945, Allied medical men and Red Cross technicians entered the horror camp of Bergen Belsen to find thousands of people in the last stages of starvation. They did not know what to do for them. They began medical treatment by feeding, orally, predigested foods, or, in the graver cases, by giving intravenous injections. The results were disastrous. Ingestion by mouth was very poorly tolerated, and injections increased the oedemas which had come from starvation. Doctors and nurses had to watch the horrible reactions of their patients, who thought that this was a new form of torture. It took time and the sacrifice of many lives to learn that the best nourishment for such cases is skim milk.

Sir Jack Drummond, the great English specialist on nutrition, published an account of the Bergen Belsen episode three years ago. In spite of the enormous progress that has been made in the science of nutrition, he said, and "although in our lifetime millions have died from starvation in Russia, China, India and elsewhere, it was not possible to find clear cut advice how to resuscitate people who are near death from this cause. That fact," he commented, "is a terrible reflection on our lack of concern for the human race as a whole."

The story of Bergen Belsen's liberation constitutes a tremendous accusation against our western civilization. It was necessary for famine to return and ravish Europe itself before western science took an interest in combating it. Two terrible world wars were necessary, as well as a great social revolution—the Russian Revolution, in which 17 million people perished, 12 million of them from starvation—before western civilization was persuaded that trying to conceal the reality of hunger was like trying to shut out the sun with a sieve.

The force of inexorable circumstance finally began to overcome the taboo on hunger. Scientists became interested, and they were permitted to study the subject objectively. Nations were urged to publish statistics on the real living conditions of their populations, and there was a move to stimulate publication of reports and essays on the forbidden subject.

4

The underlying reason for such a radical change of attitude is that the world is now passing through a revolutionary phase in its history. The two world wars and the Russian Revolution were no more than visible symptoms of the developing world revolution, cataclysmic manifestations of the impact of social forces seeking to remove obstacles from their path. But in order to make the dangerous statement: "We are living in a world revolution", it is necessary to define "revolution".

The word "revolution" is used here not in the sense of violent overthrow of constituted authority and the seizure of power, but as meaning a process of transformation of the whole, a historical transmutation which replaces one world of social beliefs by another in which the former social values no longer have meaning. I use the term "revolutionary phase of history" to refer to what Ortega y Gasset calls the "historical crisis". The Spanish philosopher explains the historical process as taking place in two ways: by the successive change of things within our world, or by a change in the world as a whole. The former is a question of "historical evolution", while the latter represents a "crisis", or "historical revolution". In our times we are witnessing a complete overhauling of the social systems and ways of life that were in effect at the beginning of the century; we are passing from one social era to another.

Julian Huxley attempted to characterize the two eras of our age by calling that which is past the "era of economic man", and that of the future the "era of social man". And, indeed, the most noticeable feature of the violent contrast between these two worlds (both embraced by the life of one generation) is a shift of the centre of interest. Until the First World War western civilization, with its exaggerated economism, was exclusively preoccupied with the technical domination of the forces of nature. And while it was thus engaged with the problems of economic exploitation and the creation of wealth, man and his problems were almost entirely forgotten. In the post-war world, however, what we see on all sides—in both the capitalist West and the sovietized East—is a concentrated interest in biological man as a concrete entity, a sort of priority conceded to human problems over strictly economic problems. This does not mean that in the "era of social man" economics will be relegated to a secondary level, but rather that it will be oriented to function in the interest of human welfare. The democracies in our day have shown themselves to be deeply concerned with the protection and biological revalorization of man, while the U.S.S.R. has developed its five-year plans in accordance with the principle of so-called Communist humanism. Present-day economic activity has ceased to be the art of establishing lucrative enterprises alone; economics is today a science that has been said to teach methods of promoting "a greater quantity of economic welfare". There are good prospects in this new era of making money serve man, instead of making man the slave of money; of organizing production to satisfy the fundamental needs of various groups of human beings, rather than letting men go on killing each other in an attempt to slake their insatiable thirst for the profits of production.

An interest in man and in the rehumanization of culture is the common denominator of both the great economic systems that are now struggling for universal supremacy. It seems to me that capitalist democracy and Russian democracy do not represent two worlds in irreconcilable struggle, but rather two poles of a single world. As social poles they have their differences and peculiarities, but the growing interest of man in man himself and the anxious search for means of collective betterment mark an area where the two systems must converge. As they come closer together they must necessarily resolve their conflicts, since they must both face the circumstance that men who live together have to get along with each other.

As our taboos were broken, and our social goals started to change, interesting studies of hunger began to appear. In 1928 the League of Nations put the problem of alimentation of populations on its permanent agenda; the League's Organization on Hygiene sponsored investigations in several countries and a series of valuable reports was published. The very first inquiries, carried on with strictly scientific method in the most varied regions of the world, revealed the alarming fact that more than two-thirds of humanity live in a permanent state of hunger.

This shocking situation, at a crucial moment of history when our only hope of finding the way to survival is to recognize the great errors of our civilization, has led the conscience of mankind to a radical change of attitude toward the problem. We have set out to face it with courage, and to solve it with energy.

Evidence of this new spirit was the first post-war conference on world reconstruction, the Food Conference called by the United Nations at Hot Springs in 1943. There the experts of forty-four nations frankly confessed the nutritional facts of their countries' lives, and planned the joint steps necessary to fulfil their needs. They proposed to erase, or at least to lighten, those black areas which represent, on maps of qualitative demography, the nuclei of undernourished and starving populations. These groups, in their physical and cultural inferiority, in their alarming death rates and their incidence of deficiency diseases like beriberi, pellagra, scurvy, xerophthalmia, rickets, osteomalacia, endemic goitre and anaemias, show their organic lacks, their total or specific hungers for one, for several, sometimes for all the elements indispensable to human nourishment.

Hunger is the most degrading of adversities; it demonstrates the inability of existing culture to satisfy the most fundamental human necessities, and it always implies society's guilt. To combat and exterminate it as the Food Conference hoped to do, it will be necessary to have broader and more intense studies of nutrition throughout the world. Every student's observations ought to be published, as contributions to the preparation of a universal plan.

One great obstacle to adequate planning is our lack of knowledge of the problem as a whole. The question of feeding the peoples of the world involves a complex of manifestations, biological, economic and social. Most scientific studies of nutrition limit themselves to one or another of its aspects and give only a unilateral view of its problems. They are almost always written by physiologists, chemists or economists, specialists whose professional lives are limited to one field.

5

Such narrowness of outlook is characteristic of western civilization. Since the middle of the nineteenth century a kind of university instruction has developed which is no longer interested in transmitting a unified image of the world, but rather in isolating, and mutilating, facets of reality, in the supposed interest of science. The tremendous impact of scientific progress produced a fragmentation of culture and pulverized it into little grains of learning. Each scientific specialist seized his granule and turned it over and over beneath the powerful lens of his microscope striving to penetrate its microcosm, with a marvellous indifference to and a towering ignorance of everything around him. Recently in Europe and the United States an extreme development of this type of university education has created within the culture a sort of civilization *sui generis*—a specialists' civilization—directed by men whose scientific outlook is rigorous but who suffer from a deplorable cultural and political myopia. Ortega y Gasset has called them the "new barbarians—men ever more and more learned, and less and less cultured". Worst of all, such men are the dominant type of our cultural élite, representatives of the social dynamic which brought us to what Rathenau so aptly called "the vertical invasion of the barbarians". The narrow specialists, "men who know more and more about less and less", are one of the most dangerous elements in our cultural life.

As a consequence of the specialists' techniques, we find that even after the cultural barriers were broken few students faced the problem of hunger in its world-wide perspective, its multiple and correlated aspects. Some serious researchers, trying to explain and solve the problem of famine, did direct attention to our classic dilemma of food production in relation to population. The works of Lord Boyd Orr, Imre Ferenczi, Frank Boudreau and a few others can be considered to have a broad outlook and to be genuinely scientific. Some of the reports of the Food and Agriculture Organization of the United Nations, such as the World Food Survey published in 1946, have the same objectivity. Unfortunately, the problem of hunger constitutes such a pointed social question that most of the speculative works dealing with it are not free of current political prejudices and superstitions.

6

Two schools of thought about world hunger are, in my opinion, really dangerous to the future of humanity, because they falsify the social reality of the problem. One theory attempts to prove that famine is a natural and incurable phenomenon; the other offers as our only salvation a forced reduction in the world's birth rate. These dispiriting and pessimistic theories can be described as products of a world in transition, speculations of minds formed in a cultural structure which has since been overthrown. Their authors refuse to recognize the social revolution as a *fait accompli*, and spin their thoughts out of data that are nothing more than hangovers and phantoms. One characteristic of historical crises, Ortega y Gasset says, is the way old social convictions tend to lose their value before new values, which will give direction to the thought and conduct of the future, are put in order. Many people are left with no way of knowing what to think, and withdraw into the past to overcome their inner emptiness.

The contention that famine results from a kind of natural law has no basis in scientific knowledge. Analysis of certain fundamental statistics will show how artificial that notion is: The oceans cover 71 per cent of the surface of the earth, and the remaining 29 per cent is the solid part of our planet. This land covers an area of about 56 million square miles, of which 30 per cent is forested, grassy plains are 20 per cent, 18 per cent is mountains and 32 per cent desert, either torrid or polar. According to Robert Salter and Homer Shantz, specialists of the United States Department of Agriculture, only 25 million square miles—half of the land surface of the planet—can be agriculturally exploited by present methods of soil utilization. Desert and mountainous regions are not considered arable, although lately there have been notable triumphs of agricultural technique in such areas. Yet this conservative calculation gives mankind some 16 billion acres to cultivate, or 8 acres per individual of our present world population. Authorities on agriculture and nutrition, studying the correlation of area cultivated and food supply in the light of modern knowledge of nutrition, have estimated that about 2 acres per person will supply the indispensable elements of a rational diet. Cultivation according to that ratio would use one-fourth of the world's arable land. As yet, the area cultivated has not reached 2 billion acres, an eighth of the earth's natural possibilities. Clearly, hunger and famine do not result from any natural law.

Half the world's land has been left out of this reckoning. Mountains and desert are not computed as useful, although hundreds of thousands of acres of tropical desert have recently been made fertile by modern irrigation, and the Russians, with their surprising agricultural processes, are adding a wide strip of polar desert to the productive area of their country. According to Mikhailov, the Kola peninsula, lying at 67° 44′ north latitude, 3° above the arctic circle, today provides wheat, barley, turnips, carrots, peas, radishes, squash and cucumbers for its 150,000 inhabitants. Still farther north, on the most northerly lands of the European land mass, only 850 miles from the North Pole on the Taymyr peninsula, plants selected according to the "vernalization" methods of the agronomist Lysenko are being cultivated, and are adjusting their growth and ripening to the short polar summer. Plantations of potatoes, corn and raspberries not only produce at such latitudes, they produce well; a variety of potato grown north of the arctic circle yields 200 quintals per hectare (17,844 pounds per acre), while in the centre of the Eurasian continent the average yield is only half as much. Veritable oases are appearing in the polar desert.

The economic value of these experiments is debatable. Disregarding them entirely, the most conservative figures of American technicians demonstrate that the problem of hunger is not one of production limited by the coercion of natural forces. Essentially, it is not a problem of production at all, but rather one of distribution. Frank Boudreau points out that "we have been more successful in producing food than in properly distributing it". War and hunger are man-made. That thesis will be supported in another chapter, but it is worth noting here that anthropologists can find no weapons or signs of organized warfare in the palaeontological deposits of the most primitive human groups, nor do their fossilized skeletons show signs of dietary deficiencies. The skeletons of more advanced societies are engraved with the evidence of dietary lacks, the biological etchings of hunger. It can be concluded that hunger and war arrived when man had reached a stage in culture when he began to accumulate reserves, and to defend his collected wealth;

they began, that is, with the difficulties man created in the distribution of natural riches.

7

Another theory of hunger accuses nature of provoking this calamity by an indirect mechanism: endowing man with excessive powers of reproduction and thus inviting overpopulation of the earth. The so-called neo-Malthusians subscribe to this idea. They would like to revive the doctrines brought forth by the English economist, Thomas Robert Malthus, at the end of the eighteenth century. The first industrial experiments gave the impression that machines could replace men completely, and some people came to feel that the production of human machines must be reduced to keep them from competing with iron ones. In England, which was the cradle of industrialism, Malthus's theories were widely accepted. Then too, as Alfred Sauvy claims, the fear of nascent socialism was responsible for the creation as well as the acceptance of Malthusian theory. Malthus found the increase of world population a great danger to its economic equilibrium, and in defence of this thesis he fathered the hypothesis that population increases in geometrical progression and the food supply in arithmetical progression. Thus as people reproduce, food production becomes irremediably insufficient for their necessities.

Malthus's theory lacked a scientific basis. His first error was to consider the growth of population as an independent variable, isolated from other social phenomena, whereas in fact such increase is strictly dependent on political and economic factors. His notion of a natural law governing the growth of population was challenged by Marx, who pointed out that what really occur are historical tendencies or cycles which change from one period to another in accordance with changing social organizations. Further, history itself has completely disproved the predictions of Malthus. For a time after the publication of his theories the growth of world population seemed to confirm his predictions, but before the end of the last century the increase had lost its impetus. Fertility began to decline in various countries, and side by side with the spectre of overpopulation appeared that of underpopulation.

The central doctrine of Malthus "was thus completely contradicted by historical evolution", says the well-known demographer, Imre Ferenczi. Dr. W. R. Aykroyd, director of the Division on Nutrition of the F.A.O., wrote in 1937 that, "Now in western civilization the spectre raised by Malthus has been laid". Yet his theory, long buried in the ruins of his frightening predictions, has lately been dug up and used to project new and still more terrifying forecasts, culminating in the prophecy of the end of a world depopulated by famine.

The revival of Malthusian theory has been possible because our period of history generates a collective receptiveness similar to that of Malthus' day. The English economist lived in a time of revolution—the industrial revolution—when people were nervous and doubtful about the future, a state of mind recurring, on a larger scale, in our social revolution. The present world situation involves such a radical transformation of social processes that it is quite impossible to foresee the future of the world. Julian Huxley has said that the present revolution, as among revolutions, is highly revolutionary!

Our blind flight into the unknown tends to frighten prudent spirits, and fear leads them now, as it did when Malthus lived, to attribute social unrest to the sheer number of human beings. When the neo-Malthusians say that mankind is starving and condemned to perish in universal famine because of its inadequately controlled birth rate, they are simply blaming the hungry for the fact that there is hunger. It seems to them that famished populations, raising the demographic pressure of the world by their delirium of reproduction, are criminals.

These criminals are guilty of the crime of hunger, for in the final analysis the neo-Malthusian theory is one of the born starveling, who starves because he is born to starve, just as the criminal, in the old Lombrosian theory, kills and robs because he is born to do so. Like born criminals, the starving deserve an exemplary punishment, and so they are condemned to extermination, either by individual starvation or by controlling reproduction until the born-to-starve disappear from the face of the earth. They are guilty of the masochistic crime of inventing hunger and suffering it.

Here is the death sentence that William Vogt, standard-bearer of the neo-Malthusians, serenely pronounced upon those great hunger-makers, the Chinese: ". . . there is little hope that the world will escape the horror of extensive famines in China during the next few years. But from the world point of view, these may be not only desirable, but indispensable." Objective data, biological and social facts will be brought to bear, in another chapter, on this issue: whether, as Vogt asserts, the famished themselves create the hunger, or whether the guilty are those who go in for neo-Malthusian theories while they defend and benefit from the imperialist type of economy.

The neo-Malthusians have invented nothing; their theories rest on the same precarious base that supported Malthus. To give a colour of reality to their prophecies, they based their predictions on the average annual coefficient of population increase during the last two centuries, and calculated that in three hundred years the world would have 21 billion inhabitants. This calculation has as little value as those of Malthus, which have already been disproved by history. The social changes of the next three hundred years may as likely bring a decrease as an increase in the present population. Since we have no information about society in the coming centuries, long-range predictions of population changes are pure speculations and consequently of no practical value.

Another alarmist idea with no basis in fact is that food production cannot be increased because we have reached the practical limits of soil utilization as well as of human saturation. The facts are, first, that of the 50 per cent of the globe's soil which can be cultivated, only 10 per cent is being used; and second, that production per acre in most of the world could be greatly increased by rational agricultural practices. The special F.A.O. committee which edited the report of the World Food Survey concluded that wheat production in India could be raised 30 per cent in ten years: 20 per cent by using fertilizers, 5 per cent by introducing new varieties and 5 per cent through protection from insects and diseases. They go on to say that after this period additional measures could swell the increase to 50 per cent. The same thing could be done in many parts of the world. Raymond Christensen estimates that half the increase in agricultural production in the United States during the Second World War was due to the introduction of new techniques.

The crop yield of wartime Britain demonstrates overwhelmingly that necessity can inspire an agricultural expansion far beyond the limits of normal expectation. Before the war the U.K. produced only one-third of her food needs and imported the other two-thirds. Under pressure of the maritime blockade, production climbed until it took care of about 45% of the national needs. This came about through an increase of about 60 per cent in the area under cultivation, which rose from 8,800,000 to 14,500,000 acres between 1939 and 1944. And all through the war, surprisingly enough, Britain's nutritional situation, far from deteriorating, improved greatly. At the end of the war, the number of her undernourished had sensibly diminished. Considering that the soils of Britain are not among the world's richest, and that they have been farmed for at least two thousand years, it is no exaggeration to say that world food production could be equally increased if economic forces were directed and co-ordinated toward that end with the determination that the English showed in meeting and surviving their siege of hunger.

I do not entirely agree with Marx's statement that production can be increased indefinitely, but I do believe that we are still a very great distance from its maximum limits. And consequently I am not alarmed by the ghost of Malthus, or, as I always have an impulse to put it, by the Malthusian scarecrow. Nothing reminds me more of this theory than the grotesque figures of scarecrows, those frightening but harmless effigies that farmers set up to scare away the birds. To the neo-Malthusians, the peoples of the world are a calamity worse than a flock of hungry birds or a thick cloud of locusts threatening to devour all the harvest of their neat little orchard which, as we have seen, occupies only 10 per cent of the surface of the earth. Against this threat to the nutritional security and general living standard of the richer populations, the neo-Malthusians hoist in the four corners of the world the scarecrows of their excess-population theories—scarecrows that are both symbols and phantoms. A poet has called them "sculptures of the fear of our people and our epoch".

8

Another, and growing, set of gloomy prophecies speculates about the effects of soil erosion. There are those who contend that if the waters continue at their present rate to take up our soils and carry them to sea, the world will soon be a dead planet, its rocky skeleton showing, no flesh of soil or living skin of vegetation covering its ancient carcass. Obviously, there is a great deal of exaggeration and sensationalism in such a statement. No one denies that erosion is a cause of soil impoverishment capable of reducing its fertility, and that it might eventually become a universal factor of hunger and misery, but this could happen only in the very distant future, and only if no protective measures are taken. To make this perfectly clear, let me point out that there are in the first place two types of soil erosion: the natural process that goes on everywhere, and the erosion provoked by man, which is limited to certain geographical areas. Natural erosion is a geological process inherent to the evolution of soils and to their vital equilibrium. It goes on slowly and almost imperceptibly, because as the winds and waters carry away the top layers of soil, building processes in the lower layers make up for the loss. What happens to the earth's skin is like what happens to our own.

When erosion is provoked by the interference of man, however, the process is different; and losing a great deal more of its richness than can be simultaneously replaced, the soil may lose its fertility entirely. It is estimated, according to Fairfield Osborne, that in the United States alone 50 million acres of productive land have been rendered sterile by erosion. But since it is no uncontrollable natural phenomenon, but rather a consequence of man's intervention, this stripping of the soil can perfectly well be halted by man. Probably, too, there is some exaggeration in the figures cited, the soil's loss of fertility being attributed exclusively to erosion when there are many other factors in its decline. If erosion were the devouring and insatiable monster that some people have painted, much of the world would already be barren and devoid of life. Take for example the Yellow River valley, cradle of Chinese civilization. Specialists in the matter estimate that the river carries a cargo of 25 million tons of soil down to the sea every year. Yet, for some 5,000 years, a human anthill has lived there, on a basis of agriculture. The valley today, subject to this terrific loss from erosion, supports one of the densest rural populations in the world, estimated by Russell Lord at more than a thousand inhabitants to the square mile. It can be deduced that erosion is not as black as it is painted; if it were, it would long ago have eaten all the land in China, swept away the "vegetable civilization" without leaving a trace, and long since have dropped it on the bottom of the China Sea.

The truth is that soil erosion and world overpopulation can at most be regarded as capable of causing hunger in future epochs, but never in our era. It seems a contradiction, even a subterfuge, to make so much noise about these latent possibilities and at the same time to pass by in silence the deleterious action of factors that operate before our eyes, and that are responsible for the decadence of the world at present.

9

Much more serious than erosion of the soil's riches, a process taking place in slow motion, is the violent erosion of human wealth, the deterioration of human beings through hunger and malnutrition. It is enough to note that throughout the Far East the roll of the under-nourished includes more than 90 per cent of the population, or that in Latin America more than two-thirds of the people are ill housed, ill clothed and ill fed. Or that in pre-war England, as reported by the scientist Lord Boyd Orr, later general director of the F.A.O., about 50 per cent of the population suffered the ill effects of hunger, 40 per cent undergoing partial starvation (specific deficiencies) and 10 per cent generalized starvation, that is, serious deficiency of all the nutritional elements.

When Hitler Germany called the young Nazis to military service in 1936, only 75 per cent of those presenting themselves could be accepted. By 1938, only 55 per cent passed muster. The number of the incompetent, the weak-minded and the deformed was growing alarmingly in the master race itself. In Argentina, a new country, it was found that between 1920 and 1940, among the men called up for military service, the percentage of rejections on physical grounds rose from 30 to 42·2. According to Guillermo Ruse, undernourishment was the principal cause for this increase in the proportion of physically unfit. Even in the United States, thought to be the best fed country in the world, the Selective Service found that of 14 million individuals examined, only 2 million, or 15 per cent, really met the required physical standards. It is not, then, any single group, or race or country that is in decadence, but all of mankind.

The purpose of this book is to study the terrible erosion that hunger is causing in the human race and its civilization, an erosion that threatens to blot from the earth all the gigantic work of man. If mankind does not try, urgently and on a world scale, to stop this corrosive action, all the creations of humanity will soon crumble and be buried in the dust of time, and that will happen long before the wind and water have consumed the incalculable potential resources of the soil. The very humanity that is frightened today by the remote danger of a world turned desert through the exhaustion of its natural resources will witness the paradoxical arrival of a world depopulated while still pregnant with fertility and geographical wealth.

I intend no gruesome prophecy of the end of the world; on the contrary, I believe in the biological and social power of necessity, which at the most critical moments in history always leads mankind to the way of survival. Hunger itself will be the guiding force, the mainspring of a social revolution that can gradually draw the world back from the abyss which threatens to swallow our civilization much more greedily than the oceans threaten to swallow our soils. This faith makes me an optimist, interpreting the social agitations and frictions of today as signs of the new era, in which the first requisite for social stability will be fulfilled—the conquest of hunger.

Although I am cheerful about the distant future, I am much more reserved in my optimism concerning the well-being and tranquillity of the present generation and those immediately to come. I am afraid that these generations will have to pay too high a prize for this magnificent conquest of hunger. Ideas take root in the world of social realities only in response to indisputable necessity at a given historical moment. A large part of the world is not yet entirely convinced of the necessity of doing away with hunger once for all. There are people who consider it more important to maintain high standards of living for their own regions, and certain social privileges for their own class, than to fight the phenomenon of hunger as such on a world scale. And as long as large groups continue to look at things in this way, the world will go on being menaced by wars and revolutions, until the absolute necessity of survival at all costs forces the privileged to abandon their privileges.

This book has been written in the hope that it can speed the maturation of this basic idea: that it is imperative to organize a world-wide campaign for the extermination of hunger. It is offered as a small contribution to our pressing collective task, the preparation of a plan for the revival of our civilization through the physical reconstitution of man. If it seems pretentious to suppose that my modest study can affect, however slightly, the universal fortunes of humanity, let me justify myself in Bertrand Russell's words: "There was never a moment in history when the contribution of individual thought and conscience was so necessary and important for the world as it is in our days." And the English philosopher went on to say "that all men, any man at all, can contribute to the betterment of the world".

Faith in human destiny, in the fruits of the social revolution through which we are living, and in the constructive force of human co-operation, has led me into this bold attempt to take the measure of hunger in its universal aspect, to probe its depth and its extension in the various human groups. It is an ambitious plan indeed, requiring a perfect balance of the strictest observation of the facts and their most impartial interpretation. That is the ideal which I should like to approach in this essay, although I am aware of the extent to which I fall short and of the misunderstandings to which I may be exposed.

10

I have tried to find a method of study that would give the broadest view of the problem, a perspective in which the implications, influences and connections of its multiple natural and cultural factors could be made intelligible. The only method that might offer such a panorama without uprooting the question from the field of social reality was the geographical—hence this "Geography of Hunger". My geographical method is not the descriptive one of the old, enumerative geography, but the interpretive method of modern geographic science.

Hunger is a word of many meanings, and I should like to define the way it is used here. The subject of this essay is not individual hunger, either in its physiological mechanism, so well known today through the masterly works of Schiff, Lucciani, Turro, Cannon, Keys and other physiologists, or in its subjective psychological aspects, the material of the magnificent novels of hunger. My purpose is to analyse the phenomenon of collective hunger, of endemic or epidemic hunger (famine) affecting great human masses. I shall deal not only with total hunger, the complete debilitation resulting from lack of food which is called starvation, and which is generally limited to extremely depressed areas or to exceptional situations, but also with the much more common and more numerically lethal "hidden" hunger which, for lack of certain indispensable nutritive elements, condemns whole population groups slowly to die of hunger although they eat every day.

These partial and specific hungers, which have been identified by modern science in their infinite variety throughout the world, are my chief concern in this study. My conception of hunger, then, embraces everything from the latent deficiencies commonly called conditions of undernourishment and malnutrition to absolute starvation. I have tried to write objectively, with a base in fact and observation, and not merely to speculate abstractly. I have documented my essay from a background that includes twenty years' experience in observing the problems of food and nutrition in Brazil—a country which for size and geographical variety is practically a continent, and from activities that brought contact with famous specialists at the successive world conferences of the F.A.O., as well as trips to three continents collecting material on the question of hunger.

11

This subject is one that is highly charged with emotion, but I shall try, barring accidents, to take sides with no party but that of scientific truth. The English agriculturist, Dr. C. S. Orwin, wrote in the preface to Bateson's book on agriculture, "I have no politics where the land is concerned." As Orwin studied the land, indifferent to party prejudice, so I shall examine the reality of hunger without preconceived ideas as to what political ideology can solve the problem. I shall attack hunger as the most pressing problem of all humanity, and therefore of all parties. If the reader feels a kind of passion in some passages of this book, it is passion for the truth, which is the poetry of science. The truth I seek is the total vision of a universal human problem.

If I sometimes seem to paint a rather black picture, and my book is itself a chronicle of calamities, let it be understood that this is the result of writing in the weighted atmosphere that the world has been forced to breathe in these last ten years. The air we live in has been contaminated by corruption, frustration and fear; it has suffocated us in the smoke of bombs and cannon, smothered us with censorship and drowned our voices in the clamour of war victims and the groans of the starving.

12

My first aim is to fix certain fundamental relationships which must be appreciated in order to plan a world policy of struggle against hunger. I propose to demonstrate that although hunger is a universal phenomenon, it is not the result of any natural necessity. The study of hunger in different regions of the world will make clear that human societies are ordinarily brought to the starvation point by cultural, rather than natural, forces, that hunger results from grave errors and defects in social organization. Hunger due to the inclemency of nature is an extraordinary catastrophe, while hunger as a man-made blight is a "normal" condition in the most aried parts of the world. Whatever land man has occupied has een transformed by him into a land of hunger!

Next I shall demonstrate that today, when all the world's parts re indissolubly linked into one living whole, it is no longer possible o let one region rot and starve without infecting the rest and hreatening the whole world with death. These ideas will be deeloped in the first two parts of the book, where the world of hunger s analysed as to its universal components and its regional peculiarties. The third section projects a world without hunger, a society reed from its terrible biological slavery. As we investigate ways of ombating hunger, it will become clear that there are effective veapons other than a drastic and forcible reduction of the world's opulation. To offset the neo-Malthusian preachment of birth ontrol as sole salvation of a supposedly bankrupt world, I shall resent the point of view of the modern geographers and social cientists, who no longer accept any form of rigid natural deterninism. To concede that the earth sets a fixed, impassable limit to uman population is to revert to the old geographical determinism f the times of Ratzel, according to which nature lays down the law vhile man is no more than a passive pawn in the play of natural orces, devoid of creative will and powerless to escape the crushing uthority of his environment. Nothing could be farther from the ruth. Man, with his creative and inventive techniques, is well able o evade the coercion of nature, to free himself of the conception of eographical determinism and to transform natural limitations into ocial opportunities.

13

The crucial point of this essay is the argument that overpopulation does not cause starvation in various parts of the world, but that starvation is the cause of overpopulation. This idea sounds paradoxical, since hunger, an agent of deterioration and death, seems unlikely to provoke an excessive increase in population. But in reality that is just what happens. Consider that the three countries of the world that are held to be absolutely overpopulated are China, India and Japan; and it appears that the more these places are assailed by starvation the more the number of their inhabitants grows. I shall explain in its proper place how hunger increases the fertility of the depressed groups suffering its permanent action. And from that evidence it is logical to deduce that although it is impossible to eradicate hunger by controlling the growth of population, it is perfectly possible to reverse the process and control the growth of population by doing away with starvation. Simply to retard the birth rate as the neo-Malthusians advocate would, with our contemporary economic framework, only diminish food production and thus increase starvation. The opposite procedure, however, that of enlarging and improving the world's demographic possibilities, re-establishing man at a healthier level, is sure to lead to greater food production.

To take a simple and concrete example: modern technical resources give promise of the eventual abolition of malaria by exterminating the mosquito that transmits it. At present, according to the World Health Organization, some 300 million people have malaria. They are people whose tired and weakened arms can do little more than lift food to their lips. If humanity should decide to put an end to malaria, as it ended yellow fever, we could shortly count on 600 million more hands capable of producing food and able to take part in the battle against hunger. Incomplete figures on the DDT. programmes in large areas of Greece and Brazil show that there has already been an immediate and spectacular rise in food production in the sections freed from malaria.

14

My survey of the means that are available for overcoming hunger will begin by examining the possibilities of treating domestic plants and animals as food-producing machines whose output can be increased in quantity and quality. There are convincing examples of these possibilities. Between the First World War and the present, for instance, scientific breeding has increased the average milk production in Denmark from 2,000 to 3,200 quarts per capita, in England from 2,700 to 3,200, and in New Zealand from 2,000 to 3,100.

Another and still more effective way to grow more food is to expand agriculture by farming new land and new kinds of soil, and by introducing new plants and animals for food purposes. Then, too, there is the recourse of exploiting virtually untapped food reserves like the great wealth of the seas, and there is the possibility of raising living things in ocean waters to provide additional human subsistence.

This study will go on to investigate the problems of food distribution, and to discuss the intelligent use of foods in accordance with the findings of the science of nutrition. My text will analyse, in short, both the productive forces and the social relations which must be brought into play in order to effect a readjustment and a fair redistribution of the means of human subsistence.

Only through such readjustment will there be hope for living in a world cleansed of the black and shameful areas of hunger. Only thus will a "Geography of Hunger" cease to exist, a tragically strange geography which, instead of describing the earth feeding man, presents man serving simply to feed the earth. What we have now is a map of misery, spotted in Asia, Africa, America and elsewhere with areas where man apparently is born for no purpose but to die and fertilize the earth. Ours is a geography of ugly scenes like those in China where, in the glowing image of Keyserling, "it is not the soil that belongs to man, but man that belongs to the soil".

CHAPTER II

THE GAMUT OF HUNGER

I

HUNGER IS AN extremely variable phenomenon. It can exist as acute starvation, turning its victims into veritable living skeletons, or it can work insidiously to produce subtle chronic deficiencies almost without outward sign. Between these extremes it can attack mankind in many strange and spectacular disguises. There is a whole gamut of the degrees of hunger, and its various effects on mankind make up an intricate and complicated history.

The purpose of this study is to draw a map showing the places on our planet where hunger is at work. Since hunger takes so many forms, the first step toward this geographical analysis is to define and characterize the commoner types of hunger with which we shall deal.

Ordinarily, when people speak of collective hunger, the images that come to mind are of famished multitudes, physically and mentally devastated by extreme starvation. One thinks of the famine-stricken masses of the Far East, of the human scrap pile of the Second World War, of the creatures hovering at the very doors of death in the Nazi concentration camps. To those who know nothing of hunger except what they read in the newspapers, this acute and violent hunger that occurs during wars or in famines that result from natural cataclysms is the only kind of hunger that exists.

Students of nutrition, however, recognize more types of hunger than the starvation which chiefly interests reporters and their readers. These other forms are less spectacular, perhaps, but they are of much greater social significance. They affect a greater number of people, and their action is continuous, working from one generation to another.

To take a concrete example, in China famines are so frequent that he country is known throughout the world as the "land of famine". A careful historical study carried out at the University of Nanking hows that the Chinese have suffered 1,829 famines during the last ,000 years—an average of almost a famine a year. At these times millions of people have starved to death. But in addition to this, one finds in analysing the vital statistics that China's tragically high rates of general and infant mortality are largely due to hunger and to the chronic under-nourishment which is a permanent condition there. It is no exaggeration to say that some 50 per cent of Chinese mortality is directly or indirectly caused by chronic malnutrition. Malnutrition works indirectly by reducing the organism to a state of debility in which it is no longer able to resist fatal infections. Thus in a given period of years the number of lives sacrificed to chronic malnutrition, or endemic hunger, is dozens of times greater than the toll of victims claimed by spasmodic episodes of famine, the periods of epidemic hunger.

In New Guinea, according to Cilenteo, eight out of every ten children die before reaching puberty. Recent investigations show that this spectacular early mortality is explained by the fact that the children are born already wasted by the starvation of their parents, and are unable to develop properly because of their very inadequate diet. Even if a terrible famine were to annihilate at one blow the whole population of New Guinea, such a disaster would be statistically less harmful than the chronic hunger which prevails in the area. The worst such a famine could do would be to kill the 20 per cent who had survived the depurative effects of hidden hunger, which normally does away with 80 per cent of the births in that region.

In China, in New Guinea, and in many other parts of the world, partial or hidden hunger is a social problem much more serious than acute hunger or famine, although it awakens much less sympathy. It is precisely in those areas of the world that are least developed economically that this kind of hunger extorts its highest tribute. The committee of experts engaged by the Milbank Memorial Fund to study living conditions in the undeveloped areas of the world had every reason to arrive at the following conclusion:

> "Perhaps the most widespread and serious disease affecting mankind—with the possible exception of some of the less spectacular psychoses—is malnutrition. It predisposes to an impressive array of diseases and ill-health. It is surely quite intolerable that malnutrition shall be permitted to continue to prejudice the health of at least 85 per cent of the population of the globe."

But just what, after all, is this terrible hidden hunger? In order to understand how it works, we must briefly review the phenomena of human nutrition, and see what goes on in the human machine to keep it vitally whole and functioning.

2

The human organism is a machine in many ways similar to machines made by man. Whatever work the organism does is the result of a conversion of energy. The fuel utilized is food, which upon combustion in the complicated human motor supplies the energy necessary to the body's vital functioning, just as coal or petroleum feed the various types of engines.

The living machine has one characteristic that other machines lack; it is able to expand its own mechanisms and to repair its worn parts through its own efforts. This is the apparent miracle of growth and vital equilibrium. It is accomplished by the utilization of food. Food furnishes the indispensable elements for the fabrication, maintenance, functioning and repair of the living machine. That is the reason for its extraordinary biological importance. That is why food is universally recognized as the most fundamental necessity of life. Through food man obtains the energy necessary to his functions, and also the indispensable raw material for the formation of his tissues and the replacement of his physiological losses.

If food did nothing but supply energy, man could live, as Hippocrates imagined, like a machine, on a single food—on one unvarying fuel. But man depends on his food to furnish a whole series of necessary substances which go to make up his complex, living architecture. Since the human organism cannot produce these substances directly, they must be included in the diet if the living mechanism is not to suffer grave deficiencies. A rational alimentation, both sufficient and complete, must be adequate in two senses: it should supply the organism with all the energy it needs, and it should furnish all the various substances essential to maintaining its equilibrium. It is believed that some forty elements are necessary for a perfect nutritional balance of the organism. If an individual does not take in as much energy as he expends, then he suffers from general hunger, or energy hunger. If the difference is considerable he suffers semi-starvation, and if the deficiency is complete, absolute starvation. That was what happened to the martyrs in the Nazi concentration camps of Europe; their rations gave them only 500 to 1,000 calories, although the average daily need is 3,000.

When, quite aside from the question of energy, the diet is lacking or deficient in one or more of the essential chemical elements, the organism suffers partial or specific hunger. Many of these nutritional deficiencies, as such partial hungers are called, have no external symptoms, although they compromise the health. Others reveal themselves openly as typical diseases—the deficiency diseases. The number of such deficiencies is very great, their intensity is variable, and their possible combinations practically infinite. The commoner deficiencies are those that result from an inadequate supply of proteins, of certain fats, of mineral salts, and of certain vitamins.

Hidden hunger poses complex diagnostic questions. It is often very difficult to identify specifically the lacking elements because others are, at the same time, abundantly present. The diagnosis of such states of hunger is indeed one of the most fascinating fields of modern medicine, one that has required great powers of judgment on the part of its investigators, the pioneers of hidden hunger. This book is not a treatise on nutrition, and I have no intention of describing all the various types of clinical deficiency. I shall, however, identify the principal deficiencies and point out their most striking peculiarities, so that the reader unfamiliar with the subject may be better able to appreciate their significance as he finds out where they exist in the present-day world.

At the same time in history that social progress was making ever more infrequent the famines that had been so common during the Middle Ages, attacks of specific hunger were becoming more frequent and more serious. Today, hidden hunger constitutes the most typical form of man-made hunger.

There are various reasons why latent deficiencies have developed so disastrously among the more civilized human societies. First, there is the dietary monotony which results when civilization leads man to base his alimentation on a restricted number of food elements. If the diet of primitive groups is compared with that of civilized man, the most notable difference is in the variety of foods available.

Primitive man had a vast number of native plants and animals at his disposal, while civilized man limits himself to a mere handful. Max Sorre calls attention to this limitation and cites the following figures: there are some 2 million known species of animals, but only fifty have been domesticated and contribute to our food supply. Similarly, out of the world's 350,000 vegetable species, only 600 are cultivated by man. Thus civilized man has confined his basic diet to a small number of products, an insignificant percentage of the natural varieties existing on the surface of the earth. A study of the primitive populations of the Gold Coast showed that the inhabitants of one small community in that region of Africa included in their diet some 114 species of fruit, 46 species of leguminous seeds and 47 species of greens. This spectacular variety of foods differs sharply from the limited habitual diet of any European or North American group.

The reduced number of food elements used by civilized groups is a direct consequence of the impossibility of supplying great demographic concentrations with a wide variety of products. Little by little, down through the ages, mankind has sacrificed variety to quantity, limiting the regular food supply to those substances of the most concentrated food value which are relatively easy to produce and to preserve. In thus limiting his diet civilized man has increased the likelihood of chronic shortages of certain essential nutritional factors, a situation which a widely varied diet would tend to correct. When many different foods are eaten, specific deficiencies that may develop one day are made up the next, while on a monotonous, never-changing diet the deficiencies are consolidated, and grow worse as time goes on.

A second practice which leads to specific deficiencies among civilized people is the common use of concentrated, purified and refined foods. Concentrated foods containing a high proportion of energy elements—carbohydrates and fat—have been developed from wild plants by specialized agricultural processes. The cereals, which represent the earliest stage in this conquest of nature, served as the foundation of the first great civilizations—the Indian, Chinese, Mayan, Chaldean and Egyptian. Because they contain a high energy potential in their easily-stored seeds, these agricultural products made possible the concentration of great populations in small areas, such as the valleys of the Tigris, the Euphrates, and the Nile.

Although cultivated cereals are rich in energy, they are generally poorer in mineral salts and vitamins than are the seeds of uncultivated native species. In Africa, the Far East and other relatively primitive areas, seeds are eaten today whose mineral and vitamin content is many times greater than that of the cereal seeds with which the bulk of humanity is fed. This explains, to a certain extent, why deficiencies are rare among primitive populations which continue more or less isolated from contact with the white man. Although their food may not be sufficient in quantity, it generally includes native products that are extremely rich in mineral and vitamin elements. It almost always happens that when these aborigines come into contact with white people, their diet, far from improving, grows worse.

Bigwood and Trolli observed this eloquent fact: the Negroes of the Belgian Congo, with their native diet based on millet, sorghum, cassava, sweet potato and other items practically unknown outside the area, show no signs of dietary deficiencies when they are examined in their native villages. But as soon as they go to work in the factories and take up a diet under European influence, typical deficiency diseases—beriberi, pellagra, etc.—begin to destroy large numbers of them. The indigenous population of the Congo has declined about 50 per cent since the European occupation, and the changes introduced by the colonizers in the eating habits of the people have materially contributed to this decline.

The technical processes that eliminate the hull of grains or other impurities presumed to exist and give us polished rice, refined sugar and low-extraction white flour impoverish the foods in vitamins and mineral salts, and lay open their consumers to specific hungers.

Another cause of the widespread existence of specific hungers among civilized peoples is the fact that a majority in these societies have lost their instinctive ability to recognize this type of hunger. Animals always feel the lack of a given food element and instinctively seek a means of correcting the deficiency, but the nutritional instinct of civilized man has become dulled to such an extent that he is no longer aware of what his organism needs in order to function well. What he feels as appetite is a kind of artificial desire not directly related to his specific necessities; it is a sort of psychical appetite directed more toward the pleasures of eating than toward the satisfaction of nutritional needs.

The instinct of animals, on the other hand, directs their appetite toward substances which can supply specific elements in which the organism feels itself deficient. The hen suffering from a calcium deficiency at laying time will hunt for a supply of the mineral and will pick plaster from the walls or seek grains of limestone in the soil. Pet cats in wealthy houses, kept on an unbalanced diet of sweetmeats, will slip off to the garden to hunt lizards or other animals, and will gnaw the bones to supply the calcium denied them in their defective domestic régime. When pampered dogs abandon their sophisticated diet and take to eating lawn grass, as if they were herbivorous, they are obeying an instinct which directs them to a food richer in vitamins. In all these animals, specific hunger gives orientation to their dietary preferences, so as to avoid the onset of serious specific deficiencies.

Man also, in special cases, obeys the instinct of specific hunger. We have the case of the primitive populations of equatorial Africa and of the hot régions of South America; suffering from a deficiency of iron because of an incomplete diet and the robbing of their blood by endemic worm infestation, they seek to overcome the shortage by eating clay. This phenomenon of geophagy is an instinctive defence of the organism in response to a specific hunger. When the Eskimos eat the more tender animal bones, or include in their diet caribou dung and the stomach contents of animals killed in the hunt, it is specific hunger for vitamins and mineral salts that leads them to make use of such apparently bizarre foods.

These things happen among the more primitive human groups. Among the more advanced, this instinctive wisdom has been virtually lost.

3

One of the most serious and widespread of dietary lacks, or specific hungers, is protein deficiency. The proteins are the essential elements in the structure of living protoplasm, and thus they represent the underlying base of life itself. They are extremely complex chemical substances, which plants synthesize by combining nitrogen from the soil and carbon from the air with other elements, by means of the energy of sunlight. Plants alone are capable of this creative miracle; animals, although they live much more intensely, cannot create living matter out of inorganic elements. For this reason man and the other animals depend on the vegetable world for their existence. In spite of his ubiquity, man can exist only where he finds a base in vegetable life. In the ultimate analysis man cannot avoid being a vegetarian; he uses vegetable foods either directly or indirectly, by feeding on animals which subsist at the expense of the vegetable kingdom.

Lucien Fébvre points out that the boundaries of human occupation in the arctic are not set, as at first appears, by the presence or absence of the reindeer which serve to feed man, but by the occurrence of the lichens and algae that feed the reindeer. Where there is insufficient sunlight for these plants to grow, human habitation becomes impossible. Thus plants constitute the indispensable link between man and his physical environment, and it is through them that the major influence of environment on human groups is exercised. We will have occasion to see that the direct influence of climate on man is relatively slight, since he escapes its effects by various technical means. It is by indirect action, by vegetable resources conditioned by soil and climate, that environment exercises its decisive influence on human society.

Each animal and vegetable species has its own characteristic proteins. These differ in chemical structure, that is, in the proportion and quality of their components, the amino acids. The biological value of a given protein depends on how rich it is in these amino acids, which are the building stones of its molecular structure. Modern studies of nutrition, in particular those carried out by W. C. Rose and his collaborators, have demonstrated that at least ten kinds of amino acids are absolutely indispensable to human alimentation, some being necessary for growth and others to health in adult life.

Now it happens that all proteins do not include in their composition all these indispensable amino acids. As a general rule, they are found together only in proteins of animal origin, in meat, milk and eggs, which are consequently referred to as complete proteins. Vegetable proteins are almost always lacking in one or more of the amino acids, and are therefore called incomplete proteins. Man, in order to live well, must always take in a certain proportion of animal proteins in his ration.

The experts suggest that, in a perfectly balanced diet, half of the proteins would be of animal origin. Since the protective foods that furnish these complete proteins are everywhere more expensive, this recommendation represents an ideal that is very difficult to attain. The less privileged classes throughout the world, and all social classes in certain poorer areas, regularly receive less protein than the quantity considered rational for a healthy diet; as a consequence, protein deficiencies are today very widespread, and the results are extremely harmful.

The Italian anthropologist, Niceforo, at the beginning of this century made some celebrated studies of the anthropology of the poorer classes, showing that groups of children from these classes were always less developed than children of similar age from the wealthy classes. This was the first objective demonstration of the biological effects of partial hunger caused by shortage of proteins. The retarded growth and substandard weight of the poor children were the primary evidence of protein deficiency. All individuals subject to the partial hunger for proteins, whether their total protein intake is below the minimum or whether their protein ration is lacking in certain amino acids, reveal sub-normal physical conditions.

Observations in all parts of the world substantiate the principle of the degrading effect of protein deficiencies on the anthropological character of the individual. Many characteristics formerly thought to be exclusively the result of racial inheritance today are known to depend in greater part on the action of environment, particularly on the type of alimentation the environment affords. McCay pioneered in seeking to relate different types of diet to the physical characteristics of human groups living in India. McCarrison, who continued the studies, demonstrated conclusively that the greater stature, stronger constitution and superior physical resistance of the Sikhs of northern India, as compared to the Madrassi in the south, are a direct result of the superior Sikh diet, and particularly of its greater richness in proteins. The Sikhs make abundant use of meat, milk and milk derivatives, while the Madrassi eat nothing but vegetables.

McCarrison conducted an experiment in which for seven weeks he fed different lots of rats on diets similar to those customarily used by the various population groups of India. At the end of this time, the rats on the Sikh diet weighed an average of 255 grams while those on the Madrassi diet reached only 155 grams. Lord Boyd Orr and Gilks observed a like phenomenon in East Africa, where they studied the Kikuyu and the Masai tribes of Kenya. The Kikuyu are farmers, living on a diet of cereals, tubers and legumes; the Masai, on the other hand, are cattle-raisers, whose diet includes meat, milk and ox-blood, which they take from the animals. These two human groups, living side by side in the same natural environment and the same climate, differ profoundly in their physical measurements. The Masai men are 3 inches taller and 27 pounds heavier than their Kikuyu counterparts. This difference is a direct result of their fundamentally different diets. The Masai, through an abundant use of foods of animal origin, enjoy a diet balanced in proteins, while the Kikuyu live under conditions of permanent protein hunger.

I have myself had occasion to observe something similar on the American continent. In the course of a study of the distribution, according to stature and predominant constitutional biotypes, of population groups in the north-east of Brazil, I discovered that the tall type predominates in the littoral regions and in the dry backland area far from the coast, while throughout the intervening jungle zone the short type predominates, and average height is lower there than it is in the other two areas. Here is the nutritional situation in each of these three areas of Brazil: along the coast the diet is high in proteins because the inhabitants live by fishing and consume large quantities of marine foods. In the backland also the protein ration is high, since it is a cattle-raising region with abundant production and consumption of meat, milk and cheese. But in the jungle zone, where sugar cane monoculture established itself and drove out all other food-producing activities, the diet is very poor, being based on cassava or manioc flour, the protein content of which is extremely low. This difference of proteins in the diet is the key to the mystery of sharp anthropological differences between three human groups living within a fairly small geographical area.

It should not be concluded, from the examples given, that protein hunger is an exceptional phenomenon. Local examples have been cited to furnish documentary proof that protein shortages bring about the physical degeneration of man, but the fact is that protein hunger, in greater or lesser degree, is universal. There is no doubt whatever that the low stature of tropical peoples is not a racial characteristic, but is the result of defective diet, that is, insufficient in proteins. The average Chinese weighs 121 pounds and the average European 139, a difference due to hunger rather than to race.

In the lands of the world which lie between the two tropics, practically all the inhabitants are of less than average height; this is true of Latin Americans, pigmies and other Negro groups of equatorial Africa, of Indians, Filipinos, Indonesians, Chinese, and others. Now all these peoples live on a predominantly vegetable diet—cereals, tubers, and legumes—because tropical soil and climate are inappropriate to cattle raising, and therefore to the production of animal products. The only exceptions, the only tall peoples living in equatorial regions, are the pastoral groups that consume large quantities of animal products: the Berber tribes of the Sahara, the Sudanese Negroes, cattle-raisers of the African savannas, herdsmen of the upper Nile, the Masai already referred to, and the inhabitants of the Punjab in India. These are the only peoples of the tropical-equatorial region who escape chronic hunger for proteins of high biological value.

But protein hunger does not only affect the human animal by worsening the physical appearance of the race; it leads to a whole series of ills. One of the most serious of these is a shocking reduction in organic resistance to disease in general, and particularly to infectious diseases. Since the First World War, the specialists have been demonstrating the fact that as the quota of proteins in the diet goes down, there is a corresponding rise in the incidence and virulence of such diseases as tuberculosis, pneumonia, dysentery and typhoid fever. When we attempt today to outline the great areas of human destruction due to tuberculosis, we see that they coincide with the great areas of hunger. This correlation is so clear that we can now safely speak of tuberculosis not only as an infectious disease, but equally properly as a disease of malnutrition—a disease of hunger. Just as well-fed individuals, whose diet is rich in iron and other essential elements, can harbour an infestation of worms in their intestines without presenting any symptoms of disease, so can they be carriers of the terrible Koch bacillus without ever becoming tubercular. The only really efficient method of tuberculosis prophylaxis in these areas of misery is to feed the population adequately, because once they are well nourished they will become in effect immunized against the attacks of the tuberculosis bacillus.

The conditions so far described are partial protein deficiencies, in which the lack shows itself only indirectly, in retarded growth or increased tendency to disease. We have still to consider the more striking conditions of extreme shortage, which bring with them typical clinical signs, the unmistakable symptoms of protein deficiency.

One of the most impressive of such symptoms is hunger oedema, which gives its victims the grotesque proportions of badly-sewn rag dolls. In hunger areas, when protein deficiency grows into famine, it often happens that excessively thin individuals suddenly begin to gain weight and to develop tumefied faces and oversize legs. This happens because of the retention of water in the tissues due to protein deficiency. During the two world wars this phenomenon was widely observed in various European countries. During the Spanish Civil War whole populations exhibited their hunger oedemas, their deformed bellies and bloated faces. But the phenomenon exists even outside of war areas. In the backlands of the Brazilian north-east it is a commonplace, during the periodic droughts, to see grotesque figures, deformed by hunger oedema. Among the fugitives seeking escape there are shrunken children, their little legs like withered twigs, carrying the huge burden of bellies swollen with the dropsy of starvation.

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Another class of specific hungers widely distributed among human beings results from dietary deficiencies in certain mineral elements. Mineral salts are as important to the organism as calories or protein. They have a myriad of functions in the vital mechanism, and they cannot substitute for each other in these functions. An otherwise complete diet which lacks a proper quantity of calcium, for example, or of iron, will seriously upset any living thing that consumes it.

The most recent investigations have revealed that there are thirteen metalloids and sixteen metals always present in living matter. Spectrum analysis has shown that seven other minerals occur occasionally. Although the majority of these mineral elements are widely distributed in nature, and consequently present in sufficient quantities in almost any human diet, there are some, more or less rare in man's environment, the absence of which frequently causes dietary deficiencies. Such deficiencies can come about in two different ways.

First, the inhabitants of a given area might not take in sufficient quantities of those foods which are the natural sources of minerals. Thus, in areas where consumption of milk, greens and fruits is low—such foods being abundant sources of mineral salts—various evidence of mineral insufficiency is usually to be found. However, such deficiencies may also occur in zones where these protective foods are habitually consumed, the reason being that these foods may be low in minerals in that particular area. The fact is that the mineral content of a given food is extremely variable, depending on a number of factors, but principally on the local soil type. Certain deficiencies are associated with certain soils, and a poor soil may in itself be a cause of hunger—specific hunger for particular minerals. The black and extremely fertile soils of temperate and humid regions are generally rich in calcium and phosphorus, but poor in iodine. Conversely, humid tropical soils of the red type (laterite) are poor both in calcium and phosphorus. Studies made in various parts of the world show that there are extreme regional and local variations in the mineral content both of the soil and of the foods grown in it.

Through food, soils exert a decisive influence on the health and vital capacity of human societies. Where there is a progressive impoverishment of the soil in a given region, the foods grown in it decline in nutritive value, with consequent deterioration of the local population. Professor E. A. Hooton of Harvard University, studying the skeletons of Pecos Indians who lived on the plains of the southwestern United States, noted that they gradually decreased in height over a period of a thousand years, while at the same time there was an increase in bone deformations and tooth decay. The evolutionary biological decadence of this society is attributed by the anthropologist to the progressive wearing out of the soil.

Although man may suffer sporadically from shortages of any or all the mineral elements that go to make up his tissues, there are only a few whose deficiency may ordinarily be considered of social significance. They are iron, calcium, sodium and iodine.

The mineral element most abundant in the human body is calcium, the principal component of the skeleton. For bone building as well as for various other purposes, the human being needs ½ to 1 gram of this element in his diet daily. Because of the very irregular distribution of calcium in the soil, and because the foods which are natural sources of calcium are very limited in number (foods such as milk, egg yolk, and certain vegetables) calcium deficiency is, of all dietary deficiencies, the most frequent and widespread. Hunger for calcium may be considered a universal phenomenon affecting all climatic zones. Its principal consequences are rickets, softening of the bones, retarded growth and tooth decay—terrible afflictions capable of causing the decline or even the complete degeneration of a race.

Inasmuch as calcium metabolism is decisively affected by vitamins and hormones, and since the production of these regulating elements depends on environment, chronic calcium hunger manifests itself with extreme variability from one area to another. It is much commoner and much more acute in the cold and temperate zones than in tropical areas, because of the difference in the amount of sunlight; vitamin D, produced in large quantities by solar radiation, has the function of fixing calcium and phosphorus in the bone structure. That is why larger doses of this mineral are necessary in cold and temperate countries, where sunshine is limited and the body does not make good use of calcium.

Although the consumption of milk in the United States is one of the highest in the world, still, according to Sherman, calcium deficiency is the commonest dietary deficiency in that country. Rickets was so common among children in England that for many years the condition was known throughout the world as the "English disease". In the tropics, on the other hand, where the soils are much poorer in calcium, and where consumption of milk and its by-products is generally much lower than in the temperate zones, rickets is rare and tooth decay somewhat less common. The reason is that in these lands of brilliant and year-long sunshine, the human organism, through the action of ultra-violet rays on the skin, manufactures large quantities of vitamin D. A magnificent equilibrium is thus set up which fixes all the calcium available.

In such areas as the Amazon, the Belgian Congo, Mexico and Puerto Rico, where calcium intake is less than half that prescribed by the specialists, rickets is practically unknown. A Mexican physician, Dr. Rogoberto Aguillar, in the course of a study concerning the nutrition of 10,000 children in Mexico, found that 5,000 of them were suffering from the most varied types of dietary deficiencies, but that there was not a single case of rickets. In Puerto Rico, where a whole population constitutes a veritable experimental laboratory of starvation, Dr. Lydia Roberts confirmed the complete absence of rickets. The fact that Negroes, who normally inhabit tropical areas, have better teeth than white populations is closely associated with a more efficient utilization of their calcium. No other people are in a position to expose themselves so extensively to the direct action of solar light as are the Negroes, who are protected from the harmful extremes of radiation, particularly from heat rays, by the rich pigmentation of their skins. Even Negroes, working almost naked on the plantations of Africa and Latin America, cannot expose themselves with impunity to the perils of sunstroke, but take refuge in the modest shade of their own skins. In spite of this protection they nevertheless make good use of the capacity for photo-synthesis of ultra-violet rays, manufacturing ample doses of vitamin D and thus fixing their calcium.

So it is seen that even though larger quantities of calcium may be taken into the body in temperate climates, the specific hunger for this element is, nevertheless, more intense and its consequences more apparent in these very regions. What happens in the tropical zones, where available calcium is scarce, is that the skeleton does not develop so fully; the average stature is lower, but the bony tissue is solidly built. In temperate areas, on the other hand, the skeletons are more elongated but more fragile, more subject to abnormalities and deformations. This tendency toward skeletal weakness in the more advanced countries, far from lessening, is apparently increasing progressively with the development of civilization. The anthropologist Hooton, speaking of the United States, says that the skeletons of grandchildren, as compared to their grandparents, are longer but slighter.

There would appear to be only one way in which civilized peoples might free themselves from the degenerative effects of a relative hunger for calcium. That would be to include in their diet, as the Eskimos do, large quantities of fish oil, a natural source of vitamin D.

Polar peoples, although they get hardly any sunlight and consume neither milk nor vegetables, do not suffer from rickets; they saturate themselves with vitamin D, which does a very efficient job of fixing the limited amounts of calcium they are able to scrape up by gnawing the bones of animals and eating the fins of fishes.

Phosphorus is the mineral element most widely distributed in the human body; it occurs in the nucleus of every cell and helps to make up the structure of the bones, but there are no known symptoms that mark the hunger for this mineral in man. It is found in so many food substances that any diet at all contains the amount of phosphorus—between 1 and 2 grams a day—necessary to the biological equilibrium of the individual. Even in tropical regions where the soils, as we have seen, are poor in phosphorus, the usual diets do not occasion a hunger for this mineral. Osteomalacia, rickets and other bone disturbances, which can be obtained experimentally in the laboratory by withholding phosphorus, are usually caused by shortages of calcium or vitamin D when they appear in man, and not by a phosphorus deficiency.

In spite of the rarity, or indeed the non-existence, of phosphorus deficiencies in the human species, our book must still concern itself with the mineral because the phosphorus-poor soils and plants of certain regions adversely affect human nutrition by hindering the raising of animals which supply protein foods. This is often the case in tropical regions, where specific hunger for phosphorus has been widely observed in cattle, goats and sheep. In various areas such as the Belgian Congo and the South African Transvaal, the poverty in phosphorus of the pastures leads to stunted growth and bone deformations in the animals—phosphorus deficiency, that is. The presence of a type of specific hunger is confirmed when we note that cattle thus attacked develop abnormal appetites, eating the bones of dead animals because they contain phosphorus and calcium. Where soils are poor in phosphorus, or where there is plenty but not in usable form (which is not uncommon), the raising of cattle becomes difficult or even impossible and the whole regional nutrition suffers.

The daily needs of an adult, according to Shermann, include between 6 and 16 milligrams of iron. It is used by the organism principally to make up the haemoglobin molecules which impregnate the red blood corpuscles. The foods that are the usual sources of iron are of both animal and vegetable origin. Among the former the most important are meat—muscles or viscera—and egg yolk. In the vegetable world the iron content of some plants varies widely with the soil type. Kenneth Beeson demonstrated that the proportion of iron in lettuce varied from 1 to 50 milligrams per hundred, according to soil conditions.

The usual sign of iron deficiency is a characteristic type of anaemia caused by lack of haemoglobin in the blood. The first cases of this specific hunger were observed in babies, milk being very low in iron. McCay observed some time ago that 50 per cent of the babies in London's poverty-stricken East End suffered from nutritional anaemia during their first year. Later it was found that this type of anaemia, associated with a shortage of iron in the diet, is also very common among adults, just as widespread, in fact, as calcium deficiency.

Unlike calcium deficiency, however, iron deficiency is common in tropical-equatorial regions. Recent studies have demonstrated that the disease which was always officially known as "Hypoemia Inter-tropical", and which affects a majority of the inhabitants of hot regions, is not a direct result of the action of climate as was thought at the beginning of this century, but is rather a manifestation of specific hunger for iron. The problem is not that these climates provoke a greater expenditure of red corpuscles, but rather that the environment does not provide enough iron to make up the normal loss of corpuscles which takes place regardless of climate. Tropical soils, especially those of the laterite type, are among the richest in the world so far as iron is concerned, but the diets of tropical countries are generally very low in this mineral.

The fact is that meat products alone—muscle and viscera—furnish iron in a highly available form, while the iron to be found in vegetables, even in those of high content like spinach, is of very uncertain availability to the human organism. Now it happens that the equatorial-tropical zone is not at all favourable to the production of animal products, sources at once of proteins and of iron. Pastures cannot exist in regions dominated by the tropical forest, and in plains areas the pasturage is so low in nitrogenous products as to make cattle-raising difficult. In the final analysis, then, although tropical anaemia may not be a direct result of the action of climate on man, it is nevertheless in large part an indirect result, since the climate creates a type of soil that leads almost invariably to a state of chronic hunger for iron.

There are two different processes that make tropical soils unfavourable to the production of proteins. First, calcium stimulates the action of nitrogen-fixing bacteria; the general poverty of tropical soils in calcium, therefore, restricts the formation of nitrates, which in turn serve as a basis for the elaboration of proteins by plants. Secondly, these soils are constantly being robbed of their nitrates because these materials are excessively soluble and are carried away by the heavy tropical rains.

The indirect action of climate as a cause of anaemia due to iron deficiency makes itself felt in still another way. Parasites—great numbers of worms—infest the body of tropical man and aggravate his alimentary anaemia. Worm infestation is a terrible thing in these areas because it attacks the population *en masse*. In the humid tropical regions of Latin America, between 80 per cent and 95 per cent of the population have worms. In India, China and other areas the percentage is even greater. In rural areas of Shantung province, China, Dr. Gerald Winfield found worm infestation in 95 per cent of the inhabitants, and in the valley of the lower Yangtze 98 per cent. Basing his estimate on the average weight of the ascarids which find a home in Chinese intestines, Dr. Winfield calculates the total mass of these worms at about 130,000 tons—all living on nutritional elements stolen from the slim rations of the Chinese!

Large-scale worm infestation, principally by *Ancilostomus Duodenalis* and *Necator Americanus*, constitutes a tremendous accessory factor in alimentary anaemia. Yet there can no longer be any doubt that, with good nutrition, these worms become quite inoffensive, sharing the régime of abundance like peaceful fellow boarders. They become quiet domestic animals, like any other. The anaemias of those with worms are cured by a good dose of proteins and iron, without eliminating the parasites that live in their intestines. All that is necessary is to furnish enough food for both man and worm. Thus in order to satisfy the nutritional needs of China, where people insist on raising worms in such extreme abundance, enough food would have to be furnished for 400 million Chinese and 8 billion ascarids which, according to Winfield's estimates, proliferate in the bowels of the coolies and mandarins.

One of the most spectacular manifestations of specific hunger for minerals is the hunger for iodine, which appears in the form of endemic goitre or endemic cretinism. Where water and soil are extremely poor in that metalloid, whole populations are liable to this terrible scourge that deforms the body and atrophies the mind. In these regions, goitre is a horrible deficiency disease that leads to degeneration of the individual.

Dwarfism, external goitre, deaf-mutism, feeble-mindedness—such are the commonest manifestations of endemic cretinism, resulting from iodine deficiency. In the course of this book we will see that on all the continents there are great human masses ravaged by this deficiency, and reduced to conditions of biological inferiority unworthy of the human species. Huge areas exist where practically all the inhabitants have goitres and show other signs of the disease as well. In the heart of the South American continent and in certain valleys of the Himalayas there are populations among which it is difficult to find an adult individual without a well-developed goitre—as though this deformation of the neck were a characteristic of the race, a hereditary mark of the human being. But it is only a mark of hunger, the specific hunger for iodine.

Under certain climatic conditions a specific deficiency in sodium may occur. This element is chiefly present in the body associated with chlorine in the form of sodium chloride, and as such is excreted by the organism. The most important vehicle of elimination of sodium chloride is sweat, which contains between 2 and 3 grams of salt per quart. In cold and temperate regions there is so little perspiration that it rarely upsets the balance of sodium chloride; but in tropical-equatorial regions, where the heat often makes individuals sweat as much as 10 quarts a day, the heavy drain on the body's sodium chloride is hard to make up in the diet. A drop in the sodium content of blood and bodily liquids leads to a state of extreme nervous depression and muscular fatigue. Among the causes of tropical neurasthenia and laziness, hunger for salt must be taken into account.

When white Europeans began to colonize tropical regions, one of their difficulties was that any prolonged physical exertion proved to be quite impossible in such climates. In a very short time the colonists felt themselves exhausted. Many of the colonizing peoples, such as the English, French, and Dutch, consistently limited their activity to colonial administration, leaving the labour of production, the cultivation of the soil and the exploitation of mines to the natives, who showed themselves to be much more resistent to fatigue in these debilitating latitudes. If the natives rebelled against doing the work, the colonists imported Negroes from similar climates in Africa, and carried out their colonial exploitation with slave labour.

Today, in the light of modern knowledge of nutrition, it is possible to explain this superiority of the Negro or the Indian over the white man, and to explain why these races are capable of hard physical work in extremely tropical climates. One of the secrets of their ability is that Negroes, and in slighter degree Indians, lose less salt through perspiration than do whites. Losing less salt, they suffer less fatigue from the same muscular exertion. This is not a biological characteristic of the race, but simply the consequence of certain customs in keeping with environmental conditions. Talberg's researches have shown that sweat secreted by skin covered with clothing contains twice as much salt as sweat from bare skin. Since the Indian and the Negro work almost naked, they lose less salt than the European with his excessive clothing, and thus suffer less from fatigue.

It is interesting that the only European colonizers who succeeded in doing agricultural labour in the tropics were the Portuguese and the Spaniards. The first thing they did in these regions was to shed their excess clothing; they worked naked from the waist up, as Negroes work in the cane fields of the Antilles, on Brazilian *fazendas* or on the cotton plantations of the southern United States. European peoples from the Mediterranean area are better than Nordic peoples at acclimatization in the tropics less because of race than habits of life—habits of food, clothing, and shelter.

This example shows how the unavoidable deficiency of one mineral—sodium—played an extremely important role in the economic exploitation of a large part of the world's surface. There can be no doubt that this specific hunger, ever since the first colonization of tropical areas, has constituted a terrible handicap to these peoples' economic and social progress.

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The most varied, the richest in nuances, of all the groups of specific hungers is without any doubt the group of vitamin deficiencies. It is also the most familiar to us. The time is long past when vitamins were looked upon as mysterious substances with obscure and miraculous powers. Today every school-child knows the names and properties of these essential elements of nutrition, whose absence results in serious disturbances of human health. The field of scientific experimentation on the subject has been wide open ever since the moment in 1897 when Eijkman induced polyneurites in birds by feeding them polished rice; it has been abundantly proved that lack of vitamins causes not only specific diseases such as xerophthalmia, beriberi, pellagra and scurvy, but also states of vague indisposition, obscure and ill-defined disturbances that reveal a hidden or latent hunger.

I am not going to describe the symptoms of each one of the vitamin deficiencies, but only to note the most striking characteristics of this group of specific hungers. In spite of the fact that the number of known vitamins grows from day to day as laboratory experimentation advances (it has already passed twenty), the truth is that only a few of them have definite social importance. Those whose absence brings about ill effects on human masses collectively are the vitamins A, B_1, B_2, C, D and G.

A great many diseases that have been identified since remote antiquity, the causes of which have long remained unknown, are due exclusively to deficiencies of the vitamins I have named above.

As long ago as the time of Hippocrates, men knew of a particular disturbance of vision which produced extreme difficulty in seeing at night—nocturnal blindness—accompanied by serious alterations in the eyeball. At that time the disease was treated with a degree of success by applying slices of fresh liver from one or another animal over the eyes. It took humanity two thousand years of observation to arrive at the conclusion reached in the early years of our century —that this disease, now known as nyctalopia, is a manifestation of a specific hunger for vitamin A. This vitamin is found in abundance in liver oil, particularly that of certain fish; there was consequently a kind of obscure logic in the prescription of the great Hippocrates.

The natural sources of vitamin A are animal fats such as milk and its derivatives as well as liver oils, and certain green plants. Their deficiency in the human diet, and the ensuing train of macabre symptoms, are not at all rare. Aside from ocular and visual disturbances, hunger for vitamin A causes retarded or arrested growth in young people. These ills have always been endemic in the interior of China as well as of Japan, where the disease goes by the name of *Hikaw*. In many other areas of the world, vitamin A starvation has taken a large number of lives; it has stunted a great many children and has led to a great deal of blindness.

The amount of blindness resulting from inadequate nutrition is much greater than might be supposed. Blindness has always increased alarmingly in the wake of great famines; the throngs of blind beggars in European towns of the Middle Ages were in large part a product of the frequent famines of that dark time. The relationship between blindness and hunger was noticed long before anyone suspected the existence of vitamins: an Irish physician, Dr. Emmet, observed that the number of the blind in Ireland increased from 13,000 to more than 45,000 after the famine of 1848, and Sergius Morgulis tells us that the terrible famine that ravaged Czarist Russia in 1898 left nearly all the children with eye infections, and that a shocking number of persons went blind.

Although hunger for vitamin A has decreased in Europe in modern times, it continues to exact heavy tribute from humanity in other parts of the world—in the Far East, for example, and in Latin America. Dr. Wallace Aykroyd, who gave many years to a study of alimentation in India, states that nyctalopia and keratomalacia continue to spread implacably in that country, especially among the lower castes where nutrition is the least adequate.

I had occasion to witness an epidemic of blindness due to nutritional causes. It was not so very long ago and right on the American continent, during an acute famine following one of the cataclysmic droughts that periodically desiccate the central part of the Brazilian north-east. This is a region of cattle raising and subsistence farming, where in normal times nutrition is well balanced, including a good supply of vitamins from milk and cheese, and green vegetables on a large scale. But in time of drought all animal and vegetable life disappears, and the local population is left to starve; when all resources are gone various deficiencies begin to appear, including that of vitamin A. The waves of emigrants who abandon their central highlands for the more humid sea coast regions are mere scraps of human beings, many of them suffering visual disturbances. Examining the human flotsam that such a tropical hurricane of drought had deposited on the beaches of north-eastern Brazil, I saw

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the large proportion of people afflicted by nyctalopia and keratomalacia.

Night blindness, that extravagant disease, has the strange effect of plunging its victims into deep shadow the moment the sun goes down. Its frequent appearance during droughts was noticed at the beginning of this century by a great Brazilian writer who has become universally known—Euclides da Cunha, whose masterpiece, *Os Sertoes*, has recently been translated into English as *Rebellion in the Backlands*. Da Cunha attributed the coincidence of night blindness and droughts to the daily eyestrain induced by the incandescent brightness of the burning air in these tragic periods of dazzling light. Science has later come along to confirm his inspired intuition; night blindness is in fact caused by the inadequate chemical recomposition of visual pigment expended by the action of light—presuming that vitamin A, which is necessary to its reconstitution, is lacking.

Hunger for vitamin B_1 also manifests itself in disorders which have been familiar for a long time. The most typical of these is beriberi, which is characterized by muscular paralysis, peripheral nervous perturbations and other symptoms of nervous or circulatory origin. It flourishes endemically in the Far East, and breaks out in sporadic epidemics in other parts of the world. One of the most fascinating chapters in the struggle of science against hunger is the discovery that this malady, which once killed several million people every year in the Orient, is simply a form of hidden hunger.

A Japanese naval physician named Takaki was the first person to suspect that beriberi was caused by a dietary deficiency. Toward the end of the nineteenth century about 20 per cent of Japan's seamen were regularly victims of this disease; on big cruisers the mortality rate varied from 10 to 20 per cent of the crew. The navies of the western countries, however, were practically free of beriberi, even in Far Eastern waters. This contrast led Takaki to suppose that beriberi was perhaps due to an inadequate diet on board the Japanese ships, where almost the only food was hulled rice.

Takaki was in charge of the Navy's medical service in 1882 when the *Rinjio* returned from a cruise with so few able-bodied men aboard that they had difficulty anchoring her. Of a crew of 276 who had begun the voyage, a 272-day cruise to New Zealand, Honolulu and South America, 169 were paralysed and 25 had died. Eighty-two men, most of them weak and ready to drop, brought the ship home. Beriberi had killed 10 per cent of the crew, had taken more than 60 per cent to the doors of death and had put the rest almost out of action.

This maritime tragedy alarmed the Japanese people, and there was further consternation when the Navy ordered another ship, the

Tsukaba, to set out immediately on the same cruise, with the same number of personnel. The public would have been horrified to know that the 276 men of the *Tsukaba* were to be guinea-pigs for an experiment by Dr. Takaki. They were to carry out a cruise exactly like that of the *Rinjio*, with the difference that their diet would be more varied, including meat, milk and vegetables. The cruise lasted 287 days; there was not a single death, and only 14 men returned with beriberi. These were the prisoners of habit who had refused to eat the varied foods that were offered.

Takaki proved his point, but he was never able to understand the mechanism by which bad diet produced beriberi, nor could he present a scientific plan to abolish the disease. It was left for a Dutch colonial physician, Dr. Christian Eijkman, to find out how beriberi worked. To Eijkman, too, belongs the honour of having initiated scientific experimentation with animals on problems of alimentation, a method which was to throw light on the deep mysteries of human nutrition.

Eijkman was a medical officer of the Dutch East Indies, stationed at Batavia. He was aware of the shocking incidence of beriberi among the Javanese natives; in the hospital where he worked, two-thirds of the patients suffered from it. The island's infirmaries were perpetually full of beriberi, or, as it was called in Java, *Kak-ke*, cases. Those victims who were not entirely paralysed dragged themselves grotesquely along on legs which were dry and withered, or swollen and deformed with oedema. Their reeling and uncertain walk, with wobbling legs and slack feet, was a daily sight which became engraved on the young doctor's mind.

A startling accident led Eijkman to begin his investigations. He noticed one day through a window that among the chickens pecking in the dusty soil of the hospital's central patio were some who limped and lost balance as though they had beriberi. He hurried out to catch them; their paralysis, on examination, proved to be indeed a perfect duplicate of human beriberi.

In trying to find out how it was that hens and human beings had the same disease, Eijkman managed to raise a corner of the curtain that veiled the mystery of beriberi. He learned that the fowl, as an economy measure on the part of the hospital administration, had the same diet as the patients; they were getting the leftovers of cooked and hulled rice which the beriberi sufferers, with their symptomatic lack of appetite, rejected.

Rice, then, carried the disorder. But how? Eijkman started some scientific experiments. The first possibility was that the rice, contaminated by the patients, transmitted their disease. Eijkman was doubtful of this, since Europeans, with their different living customs, did not catch beriberi even from the closest contact. He proved experimentally that beriberi was not a germ disease by giving separately prepared rice, hulled and cooked like that fed to the patients, to a group of chickens. There was no question of contagion here, and yet he succeeded in producing beriberi in the hens.

The disease, then, was a consequence of mistaken or deficient alimentation. Eijkman fed a second group of fowl on whole, unpolished rice and the signs of paralysis did not appear. He concluded that beriberi was due to the lack of something which existed in the covering of the rice kernel. Indeed, when he gave rice bran to chickens sick with beriberi, they got well as though by magic.

Eijkman's theories were not readily accepted. Official science was reluctant to admit that he was right; consequently, for a long time people went on dying by millions of a perfectly avoidable disorder. The intolerance and fanaticism of official science toward Eijkman's observations brought about the death of some half-million people on the American continent in our own country—between 1900 and 1910.

These were the adventurers of the Amazon rubber boom, who were struck down just as their latex was bringing them fabulous prices. Without spirit to react or to escape, these hardy pioneers perished along the river banks; it is not without reason that "beriberi" originally meant "I can't". When the epidemic ended, no one understood what had happened, but today the causes are plain to see. The disease was over when the Amazon rubber monopoly ended, and the workers could no longer afford to import the canned European foods which had been almost all they ate. Driven to planting their own cereals, vegetables and fruits, they got enough vitamin B_1 to overcome their specific hunger.

The same sort of thing happened on the rubber plantations of the Far East, but by the time these were established the science of nutrition had gained enough ground to make itself heard. The doctor and hygienist, Victor Heiser, for example, tells of visiting a great rubber plantation in Sumatra and finding a 400-bed hospital to care for the 10,000 labourers of the place. The management wanted to double its working force, and planned accordingly to increase the hospital facilities to 800 beds. Since most of the patients were beriberi victims, Dr. Heiser advised the management to develop regional agriculture instead of enlarging its hospital, and to see to it that the workers had enough fresh foods. Some time later, although the number of workers had reached 20,000, the original hospital had more room than was needed.

Typical beriberi is today becoming a rarity, but partial deficiencies of vitamin B_1, on the other hand, are growing more common throughout the world. Countless groups show signs of such deficiency, evidenced by nervousness, lack of appetite, insomnia, tendency to fatigue and so on.

In 1735 Gaspar Casal, physician at the court of King Philip the Fifth of Spain, described for the first time in clinical detail a terrible disease called *mal de la rosa*, or rose disease. It was so named because one of its common symptoms was red skin splotches which suggested the petals of a fiery rose. It had long afflicted the more miserable inhabitants of Italy and Spain, and it was particularly widespread in the province of Asturias. Casal took it to be a form of leprosy, related to scurvy.

The "Asturian Hippocrates", as this great eighteenth-century doctor was called, erred in relating the rose disease to leprosy, but he was correct in setting it beside scurvy. Scurvy and rose disease are both of dietary origin; both are manifestations of hidden, specific hunger. The rose disease has been shown to be endemic in Italy, Rumania and Bessarabia as well as in Spain, and it is known by several other names—pellagra, *Lepra asturiensis*, and "Alpine scurvy". Pellagra, an Italian name meaning "rough skin", has been generally adopted as the most expressive.

At the beginning of this century, doctors in the United States began to point out that pellagra was a serious problem in the south, where it was decimating the rural population, particularly the Negroes. Its symptoms were the same as those of Casal's day—cutaneous, digestive, and nervous symptoms. The victims suffered first from digestive disorders, later began to exhibit ugly sores, and ended up in the insane asylums with hallucinations and delirium.

For centuries nobody had guessed the cause of pellagra. It was a glaring fact that the disease attacked only the poor—the unfortunate, poorly fed, and undernourished. Certain observers noted that with better food the patients got better, but they drew no practical conclusions from this fact. At first it was thought that the disease was contagious, that it was caused by an infection; later, since it was endemic to the areas where corn is the principal food, it was considered a poisoning due to some toxic substance in corn.

To the American scientist, Joseph Goldberger, goes credit for the discovery, during the years of the First World War, that pellagra is a manifestation of specific hunger. He conducted experiments with animals and with human beings to prove his point. Submitting one group of prison inmates to a special diet, he obtained pellagra experimentally; on the other hand, he injected the blood of pellagra victims into himself and his co-workers to prove that the disease was not contagious. He even went so far as to swallow pills containing pulverized faecal matter and scabs from the sores of pellagra sufferers, without ill effects—thus absolutely eliminating the hypothesis that the disease was contagious. In order to see what could be done through control of the diet, the scientist crowned his experiments by wiping out pellagra in two southern orphanages where the disease was a veritable scourge.

In 1914, when Goldberger began his pellagra studies, statistics registered 11,000 deaths annually caused by this disease in the southern United States. That year 1,192 individuals died of pellagra in the state of Mississippi alone. This was the centre of the plague area; as the Amazon, during the rubber boom, became the "river of beriberi", so the Mississippi was a "pellagra river". Along the banks of this river, blooming with white cotton fields and peopled with the descendants of African Negro slaves, pellagra had firmly established its terrorist rule.

Goldberger carried out his decisive experiments in two Mississippi orphanages, one Baptist and the other Methodist. Among the inmates of these two homes in 1914 there were 200 pellagra victims, 130 in one and 70 in the other. The experiment began with the addition of meat, milk, and eggs to the children's diet. In a few days the pellagra splotches began to disappear, the fiery roses faded; tired and depressed children took on life and strength. The following year there was not a sign of the disease to be found in either institution. Thus the hidden cause of the disorder was found, as well as the means of avoiding it.

The cure, scientifically so simple, was from a social standpoint very complicated. To avoid or cure pellagra, all you had to do was prescribe a varied diet containing meat, milk or eggs. But it happens that pellagra is a disease of poverty and flourishes precisely among the poor, who cannot afford the most fundamental necessities—whereas meat, milk and eggs are among the most expensive foods everywhere in the world.

When Goldberger arrived at this stage in his research, therefore, instead of enjoying his victory, he fell into profound depression. He was impotent to exterminate the evil; the remedy was not within his reach, but depended on complex economic factors. He had his co-worker, Sydenstricker, prepare statistics on the living standards of the southerners, their wages and purchasing power, and he was forced to the conclusion that these people could not, in fact, afford any other food but the corn and sowbelly they had always eaten. Fresh meat, eggs and milk were completely out of their reach. They could only go on dying of pellagra. Then it was that the scientist wrote these ironic words: "After all, I am only a simple doctor, and there is nothing I can do to change the economic structure of the south."

The feudal, slave régime of southern agriculture, based on the monoculture of cotton, implanted pellagra in this region of the United States just as the monoculture of sugar planted vitamin hunger along with the cane in certain of the Antilles, and as the mono-exploitation of rubber brought beriberi to the Amazon basin.

In each of these cases, hunger has been cultivated by man himself; it has arisen as a man-made plague.

Ugly cracks in the corners of a child's mouth have always been a badge of poverty and neglect, a kind of insignia of class. They mark not only children but adults too, inhabitants of the tenements, the Hoovervilles and the rural slums of the world. Long as such cracks have been the sign of a hard and comfortless life, devoid of cleanliness and hygiene, it was only recently discovered that they reveal a type of specific hunger. The condition was thought to mark a transmissible disease which spread easily through the promiscuous life of the less favoured classes. This contagiousness explained its wide dissemination. But the recent work of Oden and Sebrell has demonstrated that mouth cracks are caused by a deficiency of vitamin B_2—riboflavin—which is found abundantly in liver, milk and certain vegetables. Other symptoms of riboflavin deficiency are inflammation of the tongue and blood-shot eyes. In certain regions, such as the southern United States and the sugar zones of Latin America, this condition is very widespread. Spies and his co-workers, indeed, believe it to be the most general of all dietary deficiencies in the southern United States.

In the area of sugar monoculture in north-eastern Brazil I have seen many cases of riboflavin deficiency; they were hard-looking individuals, whose cracked lips and congested eyes gave them an evil expression. It is very possible that the legendary evil temper of these hombres with the bloodshot eyes, their irascibility and questionable conduct, all have their base in the dietary deficiencies to which they are commonly subject. A shortage of riboflavin, vitamin B_2, causes the eye congestion, and is generally associated with a shortage of vitamin B_1, thiamin, which protects the nerves and the deficiency of which upsets the nervous system, making the individual quick-tempered and violent. In the sugar areas of Brazil, many people with bad police records show, upon clinical examination, evident signs of these vitamin deficiencies. It is very possible that the perverse facial expressions of such people, the hostile looks in which Lombroso would immediately discern the born bandit, and their actual criminality as well, may be due in large part to loss of nervous control resulting from specific hunger.

A disease that has been known since the most remote antiquity, and which has martyrized man for centuries, is scurvy. Scurvy is unquestionably one of the most terrible manifestations of specific hunger.

Hippocrates mentions an ugly disease provoking frequent haemorrhages and repulsive ulceration of the gums—cardinal symptoms of scurvy. Wherever man attains a certain degree of civilization and consequently begins to use artificial, preserved, and excessively treated foods, scurvy immediately puts in an appearance.

In times of war, on long sea crossings and during economic crises, scurvy has been one of the more vivid of human miseries, gaudy with blood from the haemorrhages of its victims, the strange bruised appearance of their purple skins and the ghastly stench of their rotting gums.

Caius Plinius relates that during the war with the Teutons during the first century after Christ, the invading Roman troops were almost exterminated, on the banks of the Rhine, by a horrible illness called *stomacace*, whose description coincided exactly with that of scurvy. Throughout the Middle Ages, scurvy was always to be found in the martyrology of the crusades and in the periodic waste of the great famines. Scurvy's blackest chapter, however, was written during the Renaissance, in the flesh of those intrepid navigators who threw themselves into the mad adventure of discovering seas and shores unknown to European man. During the fifteenth and sixteenth centuries, the crews of sailing ships feared scurvy more than hurricanes. In the long nights of the interminable crossings, tales were told of the historic ravages of this disease, of ships found derelict, floating at random, their crews dead of scurvy. These stories were not mere legends. When the great Portuguese navigator Vasco da Gama led the first maritime expedition to India in 1497, scurvy struck so violently that there were often only half a dozen sailors in condition to work on any one of the four caravels that made up his fleet. Over 100 men were lost during the frightful epidemic. The great Portuguese poet Luis de Camoens, in his famous epic *Os Lusiadas*, gives a perfect description of the disease and attributes it to dietary causes, particularly to the spoiled provisions eaten on board the ships.

On one of the voyages of Christopher Columbus to the New World, in the first years of the sixteenth century, there came about a strange episode. It is said that some Portuguese sailors, seriously sick with scurvy and aware of the dark destiny that awaited them, begged the captain to leave them on a deserted island that came in sight. They wanted to die peacefully, and to avoid having their bodies thrown overboard to be eaten by fish. Columbus granted their request. The men, while they awaited their certain death, began to eat some of the leaves, fruit and woodland sprouts that the fertile island provided. Months later, when the ship returned by the same route, the pilot saw men signalling from the land; when the ship put in to shore, there were all the sailors who had been left for dead. They were full of life and health, cured by the fresh foods. The island where this miraculous resurrection took place is situated in the tropics, at 12° north latitude, and is today called Curaçao. The name is linked to this episode, since "curaçao" means "cure" in Portuguese—it is the island of the miraculous scurvy cure.

Some years later, something similar happened to the crew of the French commander Jacques Cartier, sailing up the St. Lawrence River in Canada. His sailors were all suffering from scurvy, when upon a suggestion of the local Indians, Cartier gave them pine-needle tea. They all recovered as though by miracle. Unfortunately, these occurrences remained practically unknown, and for two more centuries scurvy continued its destructive work upon the high seas.

During the seventeenth and eighteenth centuries England, queen of the seas, paid the world's highest tribute of lives to scurvy, until the surgeon of the ship *Salisbury*, of the English Royal Navy, resolved to make an experiment. It was similar to the one carried out by Dr. Takaki. Dr. Lind divided the scurvy victims on board his ship into various groups, and submitted each group to a special diet which consisted of the normal ship's fare plus one or another new element. He discovered that the group receiving a supplementary ration of orange or lemon juice got well very rapidly. From then on, a daily dose of lemon juice was prescribed for the sailors of the English Royal Navy when on voyage, whereupon scurvy beat a strategic retreat, delivering the dominion of the seas over to the English without further argument.

Not until our own century was the mystery of scurvy cleared up and biological explanation given for the cures that saved Columbus's mariners on Curaçao, Cartier's in Canada, and the English Navy on all the seven seas. The Norwegian doctors Holst and Frohlich, in 1907, produced scurvy experimentally in guinea pigs by feeding them dry foods, and then cured them with fresh. These investigators got far enough to prove that the disease is caused by the absence of an antiscorbutic principle which exists in lemon and orange juice, cole, pine needles, and other foods. Other investigators, among them the Hungarian, Szent-Cyorgi and the American, Charles King, succeeded in isolating this element of nutrition, and identified it with ascorbic acid, that is, vitamin C. The richness of various plants in this substance explains the rarity of scurvy in equatorial-tropical regions of the world and its frequency in cold zones where vegetable life is precarious.

Hunger for vitamin D manifests itself in two typical deficiency diseases: rickets and osteomalacia. Rickets is a children's disease, characterized by crooking of the long bones, particularly those of the legs, by deformation of the skull, which is usually large in proportion, by anaemia and chronic fatigue. Osteomalacia is the adult form of rickets, characterized principally by a progressive softening of the bones, which curve alarmingly under the weight of the body, and by the accompanying pain.

There is evidence of rickets having existed in the cold and temperate zones from the earliest antiquity. Skeletons from th period of Roman expansion in the first century after Christ, du up on the plains of Hungary, show the extreme frequency of th disease in that epoch—such a striking frequency that it led th Hungarian anthropologist Móra to make the picturesque statemen that the whole Hungarian people of that period seemed to hav been made to serve in the cavalry, because their legs were arche like the letter U.

It was early noted that rickets attacked northern lands in particular, where there is little sun, and that its favourite victims wer the children of the poorer classes. In 1660 the English physicia Glisson furnished the first complete description of this disease, s widespread in England, and since then it has been known throughout the world as the "English disease". The fact is, however, tha rickets is not a privilege of that people alone. In 1921 the America specialists Hess and Unger showed that two-thirds of the childre in New York revealed signs of rickets, in one or another degree, an that in the Negro and Italian sections it affected practically 10 per cent. According to Dr. Wallace Aykroyd, out of every tw children born in Paris before the First World War one wa rachitic.

If rickets has long been familiar, so too has been the empirical knowledge that it can be avoided or cured by the use of cod-liver oil or by prolonged exposure to the sun. It seems to have been the Norwegians, living in an eternally cloudy climate and hence extremely susceptible to the disease, who first initiated, and with great success, the use of cod-liver oil. Some there are who attribute the indomitable energy of the Vikings, who dominated the Northern Seas in the eighth and ninth centuries, and won a great empire, to the power of this miraculous and evil-smelling oil.

Studies made during the First World War by the English physician, Mellamby, and shortly afterward by the American, MacCollum, led to the discovery, in certain oils and fats, of an antirachitic vitamin—vitamin D—which regulates the calcium and phosphorus metabolism, and whose deficiency can cause rickets. Windaus and Stembook demonstrated that the ultra-violet rays in sunlight are capable of producing the vitamin at the expense of other bodies existent in the skin—the sterols. These discoveries explain the distribution of the disease in certain areas and in certain social classes. They make clear the reason for its greater frequency in geographical zones of little sunlight and among the less well-fed classes, who have neither fats such as butter, nor fish oils, to cover their vitamin D requirements.

In the tropics, where there is a great deal of sunlight, vitamin D deficiency can hardly be said to exist, because the sun, activating the sterols of the human skin, pours forth this vitamin like a divine manna from the cornucopia of the heavens. There are, unfor-unately, special cases, even in these areas, where for reasons of eligious and moral prejudice this great source of life is wasted, and vitamin D deficiency sets in, with its suite of degrading consequences. Osteomalacia is very common in northern India, where t attacks the upper-class women, forbidden by the Mohammedan custom of "Purdah" to expose themselves to sun or fresh air. The same thing happens among women of the upper classes in China.

Two centuries ago, the Polynesians of the South Seas enjoyed magnificent constitutions and extraordinary physical resistances; they were the Vikings of the Pacific, the great navigators and ishermen of the Far East. Their habits of living semi-naked in the open air gave them as much vitamin D from the sunlight as the original Vikings got through cod fishing in the northern seas. But the eighteenth-century French colonizers arrived accompanied by Catholic missionaries, who in the name of morality covered those splendid naked bodies with heavy clothing, cutting off their healthful supply of vitamin D. The result was tragic: that strong and healthy people began suddenly to waste away, to suffer from rickets, and were virtually exterminated. Of the 100,000 people who lived on the Marquesas Islands, no more than 12,000 are left today. In Hawaii, and on Tahiti and Guam as well, white civilization practically did away with the native civilizations. The natives rebelled against the moral impositions of the colonizers only on the islands of Fiji, Samoa and Wallis, where they went on wearing simple breech-clouts and enjoying the benefits of the sun. And on those islands where there is no hunger for vitamin D, the populations continue to flourish and increase.

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We have passed in review the principal forms of hunger, with their individual characteristics. I should like to point out, however, that it is exceptional for any one type of deficiency to appear by itself. What generally happens is that several of them exist together, making up a diagnostic picture of extreme complexity. Certain diseases which until recently have been ascribed to the lack of a single essential food element are today known to be due to the deficiency of a number of elements at once. Pellagra, for instance, is no longer taken to be a specific hunger for nicotinic acid alone, but rather for a variety of essential elements. In explaining the pathogeny of certain forms of beriberi, too, there is a tendency to find several deficiencies responsible.

Whether they come singly or in battalions, specific hungers are powerful, and they leave their signatures on the bodies and souls of human beings. The truth is that no other environmental factor acts upon man so despotically, nor leaves so deep a mark, as the factor of nutrition.

Man with his technical abilities may escape the direct action of his environment, may create an artificial climate—the human climate—but he cannot escape the indirect influence of nature. Nature exercises its control through the resources that the environment offers, especially the vegetable life. The botanic cover of a region is the indissoluble link that connects a human society with its physical environment—its particular kinds of soil and climate.

The alterations that dietary deficiencies can produce, experimentally, in certain animal strains make clear the extraordinary role that diet must have played in the development and biological evolution of our various racial groups, and in fixing their individual characteristics. We know today that many physical characteristics that have been cited as indications of racial superiority or inferiority have nothing to do with race, but are exclusively the results of the moulding power of diet. Such characteristics are much more closely related to food resources and eating habits than they are to heredity. To demonstrate the power of this shaping action of alimentation, Karl Mickey cites the case of Shetland ponies.

On the Shetland Islands, at the northern extremity of the British Isles, 60° north latitude, grew the smallest horses in the world, hardly more than toys for children. It used to be thought that these Shetland ponies constituted a separate race of horses, stabilized by inbreeding—until some business men decided to supply the American market by raising ponies in the United States. To their great disappointment, the ponies born under these new conditions got bigger and bigger, generation after generation, until they were the same size as horses of other "races". The fact is, there are no separate races of ponies. Shetland ponies are descendants of English horses, brought to the Shetlands from other parts of the British Isles; the extreme poverty of the northern soil in certain minerals, and the consequent poverty of the pastures, led to a progressive deterioration of the species. Even after hundreds of generations, when the ponies were taken to areas with richer soil they regained the characteristics of their ancestors.

Exactly the same sort of phenomenon takes place with certain human groups. The Chinese and Japanese may be considered "human ponies", their height and weight reduced by chronic malnutrition. It cannot be denied that individuals of these races, emigrating to the United States, take only two generations to produce descendants with a significant increase of several inches in height. The anthropologist Torday observed that another group of human ponies, the pigmies of equatorial Africa, lose their pigmy characteristics when transplanted to the plains regions where agriculture and cattle raising provide much more varied alimentary resources than their customarily extremely limited diet of wild products of the rain forest. Thus the so-called "inferior races" turn out to be starved races; properly nourished, they are in all respects equal to the would-be "superior races".

Not only by acting on his body—degrading him in size, withering his flesh, gnawing at his viscera and opening wounds in his skin—does hunger destroy the human being. It also acts on his spirit, on his mental structure and his social conduct.

Starvation itself, as distinguished from the various chronic, latent, and specific hungers, ought first to be considered in studying the effects of hunger on human conduct. No other calamity so damages and shatters the human personality. Lashed by the imperious necessity of eating, a starving man is capable of the most extraordinary actions. His behaviour changes as radically as that of any other animal tortured by hunger.

Laboratory workers are familiar with the change that comes about when normally docile rats are put on a starvation régime. They are transformed into wild animals, which bite ferociously. In disaster areas, where there has been wholesale starvation, animal life is similarly altered. During one of the great droughts of the Brazilian north-east, there was a frightful plague of bats; these normally nocturnal creatures became active day and night, and swarms of them invaded houses, sucking the blood of children and even attacking full-grown men. Serpents, too, become frenzied in these Brazilian droughts: rattlesnakes come out of their dens and move in bands through roads, corrals, farmyards and even houses, searching for prey. During the Spanish Civil War, the depredations of stray dogs in the streets advertised the famine which struck Barcelona.

Men, subjected to total hunger, react as violently as animals. The overwhelming action of hunger dulls all of man's other vital interests and desires, even suppresses them completely. His whole thinking is actively concentrated on finding something to eat, no matter what the means, no matter what the risk. Pioneers and explorers who have fallen into the clutches of hunger have left us full documentation, rich in details, of this tremendous obsession, when the spirit is polarized by one desire, concentrated on a single aspiration: to eat.

In the power of this anguished desire for food man quickly puts aside his other desires, including those of a sexual nature. It is a commonly observed fact that both men and animals subjected to acute and long-continued restriction of food intake lose their interest in sex as well as their reproductive capacity. If at the beginning, in the phase of initial exaltation, hunger sharpens the sexual appetite, as Sorokin correctly states, there follows immediately a stage of decline, and even complete loss, of the reproductive instinct.

Dr. Ancel Keys and his co-workers at the University of Minnesota registered the dramatic decline in sexual interest among a group of boys who submitted voluntarily to an experiment in semi-starvation. These investigators state that at the end of six months of hunger sexual interest was extinct in almost all the individuals. Similar phenomena were noted in concentration camps during the last war. Colonel Eugene Jacobs, who studied the effects of hunger during thirty-eight months that he spent in prisoner-of-war camps in Japan, has reported that under the action of hunger there is a rapid and universal loss of libido.

Today we know that the loss of libido through starvation is due in part to the individual's exclusive mental concentration on the search for food, and in part to the absence of that stimulus normally provided by the hormones that control sexual reactions. The genital glands of men and women suffer acutely from sharp restriction of nutriment, and their production of hormones is at length paralysed. During the Russian famine after the First World War, it was noted that spermatogenesis ceased entirely in a large number of men, and the number of women with amenorrhoea increased alarmingly.

Lack of the male sexual hormone, due to hunger, may go so far as to induce the appearance of female secondary sexual characteristics such as reduction and loss of the beard, smooth, soft skin, or the development of breasts. Reading about these cases, which occurred on a large scale during the last war, makes me wonder whether the beardless faces and the smooth, feminine complexions of Chinese men may not be related to the fact that this people has been exposed to an interminable series of famines.

Hunger disintegrates the personality by vitiating or suppressing its normal reactions to any and all environmental stimuli not related to satisfaction of the instinct to eat. The other forces that mould human behaviour are brushed aside. Attitudes of self-preservation and mental control are progressively lost until finally all scruples and moral inhibitions disappear. In this condition more than in any other man appears as the beast of prey to which Spengler refers, given over to "the supreme form of active life, the extreme necessity to assert oneself, fighting, conquering, and destroying".

The sensation of acute hunger is not continuous; it is intermittent, with periodic ups and downs. The first stage of starvation is an abnormal nervous excitement, an extreme irritability, and a violent exaltation of the senses. This is immediately followed by apathy, extreme depression, nausea, and inability to concentrate. Knut Hamsun faithfully describes the cyclical emotional crises of the starving in his famous autobiographical novel, *Hunger*, where he shows his hero passing from extreme irritability to morbid indifference, now arrogant, now gentle, now perverse, now magnanimous, all without apparent reason.

In the course of this study, I shall call attention to various social phenomena—banditry and morbid mysticism in certain backward areas, continual revolutions in others, prostitution and moral depravity—all of which are the more or less direct consequences of the dissolvent effects of starvation on the equilibrium and integrity of the human personality. In the experiments of Dr. Keys to which I have referred, there developed in greater or less degree a veritable hunger neurosis, accompanied by dangerous anti-social reactions. And the climax of starvation is accompanied by a state of rage or madness well known to the sixteenth- and seventeenth-century navigators, who called it "hunger hydrophobia".

The effects on the spirit of undernourishment, or chronic hunger, are less spectacular than those of starvation, but more prolonged and persistent in their action. While acute hunger usually causes some form of abnormal excitement, chronic hunger tends to induce depression and apathy. People suffering from chronic hunger soon lose their appetites, no longer feel the sensation of hunger, and thus cease to react to the spur which is man's strongest goad to action.

Chronically undernourished populations are almost insensible to their lack of food; their appetite is scant, and sometimes even disappears. To awaken the dulled appetite of undernourished peoples, it is often necessary to stimulate it with appetizers such as pepper and other pungent spices. This is the case, for example, in Mexico, where the anthropologist Ramos Espinosa says that the people "in order to overcome their lack of appetite, cauterize their mouths and stomachs with pepper, so as to produce a reflex secretion of saliva similar to that induced by a good appetite".

Some laboratory experiments which I have made confirm the fact that certain types of specific hunger lead to loss of appetite. Rats were fed an apparently normal ration, but one from which certain amino acids, substances which form proteins, had been removed. This experimental deficiency brought about an immediate and striking loss of appetite, but the animals again ate voraciously when the same diet was supplemented with a few milligrams of the missing amino acids.

It is the same nutritional phenomenon that makes the Chinese content with a handful of rice a day, that satisfies the Mexican with nothing but a tortilla and a cup of coffee, and that permits the man of the Amazon to go to work among the rubber trees with nothing in his stomach but a little manioc porridge—which he eats again when he gets back to his cabin at night. This kind of hunger explains the loss of all ambition, the lack of initiative, on the part of the marginal populations of the world; in diet and not elsewhere are the origins of Chinese submissiveness, of the fatalism of the lower castes in India, of the alarming improvidence of certain populations in Latin America.

Melancholy is another emotional symptom of chronically hungry peoples. There is no such thing as a melancholy race—as some lyrical and superficial sociologists would have it. But there are melancholy peoples, sad with the sadness brought on by hunger, who are often unable to cheer up even under the influence of alcohol. The sadness of the Mexican Indian, for example, is a result of his scant and deficient diet based on corn; not even his *pulque*, with its high alcohol content, can overcome it.

The celebrated gaiety of the French, on the other hand, is due to their abundant and normally well-balanced diet. A year after the end of the Second World War, I saw that hypothesis confirmed. One beautiful sunny morning, a trainful of children was setting out for the country from one of the Paris stations. From a car alongside I could watch these children for the few minutes before the train pulled out; and I was struck by their odd seriousness, by their silence and lack of spontaneous gaiety. The fine day, and the fact that they were on their way to a picnic, made their solemnity seem incongruous. I looked more carefully, and all became clear—their pinched and pallid little faces, their wan and wrinkled skin, were evidence of the awful hunger that devoured them from within. Those little offspring of the gay Gallic race had lost all their joy of living in the bitter struggle against hunger!

In its sexual effects, chronic hunger, whether specific or latent, operates quite differently from acute starvation. Starvation is known to diminish libido; groups of people subjected to persistent malnutrition, on the other hand, appear to be sexually stimulated. They show a definite increase in fertility over the less badly fed. This intensification of the reproductive capacities in chronically starved people develops through a complex process involving both physiological and psychological factors.

The psychological effect of chronic hunger is to make sex important enough to compensate emotionally for the shrunken nutritional appetite. Under normal conditions, it is universally agreed, the instincts toward reproduction and nutrition compete with each other, and when one retreats, the other advances. When chronic hunger, then, particularly hunger for proteins and certain vitamins, produces chronic lack of appetite and loss of interest in food, the sexual instinct becomes dominant. The chronic starveling, whose appetite for food is dulled and easily satisfied, turns his attention away from his weakened nutritional instincts. The biologically important and psychologically satisfactory activity which presents itself is sexual. Thus one primary need is emphasized to compensate for the diminution of the other.

The exaggerated sensuality of some societies or social classes who live in a state of chronic undernourishment is explained by this mechanism of compensation. Their high fertility index, however, is also due to an important physiological aspect of hunger.

Cattle raisers have long known that animals which get too fat may become sterile, and that reduced rations will re-establish fertility. This empirical evidence has caused no great stir in scientific circles. But there are today experimental data and systematic observations which explain the correlation between food and fertility. They make clear the way in which partial nutritional deficiencies work to accelerate the multiplication of a species.

Hunger for proteins, involving a deficit in certain important amino acids, increases significantly the fertility of animals. Proof of this is in the sensational experiments of J. R. Slonaker, which have not yet had the recognition they should and must receive. Slonaker subjected groups of rats to diets which varied in protein content, and studied their reproductive indices for six generations. He found that diets rich in proteins, when proteins constituted more than 18 per cent of the total calorie intake, were unfavourable on all counts to the reproduction of the species: they increased sterility, retarded the epoch of fertilization of the females, and reduced the number of litters and the number of young in each litter.

Some of Slonaker's figures speak with such eloquence and discrimination that they merit presentation in detail. Slonaker observed that when male rats received a diet with only 10 per cent of its total calories in proteins, 5 per cent of them were sterile; when the protein content of the ration was increased to 18 per cent and 22 per cent, the sterility increased to 22 per cent and 40 per cent respectively. With females, the same increase of protein in the diet lifted the sterility rate from 6 per cent to 23 per cent and 38 per cent respectively. There were impressive differences in the average numbers of offspring of the various groups of rats. Eating 10 per cent protein, each rat produced an average of 23·3 offspring; with 18 per cent protein, 17·4; and with 22 per cent, only 13·8.

These figures clearly demonstrate that in proportion as the diet increases in protein content, reproductive capacity drops. It is also true, however, that the larger protein rations bring about a better resistance to disease in the young and an increase in the percentage of those that survive. It appears, then, that with a percentage of proteins high enough to guarantee a good survival index among the offspring, the number of these offspring falls off; and that when diets are inadequate in protein, nature multiplies the number of offspring so as to guarantee the continuation of the species.

With the human species, the case is the same. The groups with highest fertility are those who have the lowest percentage of complete proteins, animal proteins, in their regular diets. The highest birth rates in the world are registered by certain peoples of the Far East, Africa and Latin America, where the proportion of animal products in the habitual rations does not reach 5 per cent of the total food consumed. In contrast to this, the lowest birth rates exist among the peoples of western Europe, the United States, Australia and New Zealand, where the proportion of foods of animal origin in the ration reaches, respectively, 17 per cent (western Europe); 25 per cent (United States); and 36 per cent (Australia and New Zealand).

Geographically, the countries with high birth rates (above 30) are all tropical countries, whose geographic and economic conditions are ill adapted to either the production or the consumption of proteins of animal origin. The predominantly vegetable diet of these countries is certainly one of the decisive factors in their fertility. If we compare the birth rate with the consumption of animal proteins throughout the world, we find a frank correlation between the two factors, the fertility going down as the consumption of such proteins rises.

The table below is made up of countries with birth rates which vary from the highest to the lowest. It makes clear the significant correlation between fertility and protein consumption:

Countries	*Birth Rate*	*Daily Consumption of Animal Proteins, in Grams*
Formosa	45·6	4·7
Malay States	39·7	7·5
India	33·0	8·7
Japan	27·0	9·7
Jugoslavia	25·9	11·2
Greece	23·5	15·2
Italy	23·4	15·2
Bulgaria	22·2	16·8
Germany	20·0	37·3
Ireland	19·1	46·7
Denmark	18·3	59·1
Australia	18·0	59·9
United States	17·9	61·4
Sweden	15·0	62·6

The exaggerated multiplication of humanity through excessive fertility, then, is ultimately a problem in specific hunger—one of the strangest aspects of the phenomenon of universal hunger. Hunger is responsible for the overproduction of human beings, excessive in number and inferior in quality, who are hurled blindly into the demographic metabolism of the world.

This manifestation of hunger is of primary importance to my study, since it provides a biological basis for my theory that specific hunger is the cause of overpopulation. The bodily mechanism through which chronic hunger exerts its disturbing and debasing force on the demographic evolution of human societies is involved with their economic and social life, and can best be discussed in connection with them. I shall describe its physiology when I take up the problem of hunger in the Far East—an area where relative overpopulation is plainly one of the most peculiar and serious consequences of specific hunger.

PART II

CHAPTER III

HUNGER IN THE NEW WORLD

INVESTIGATIONS OF LIVING conditions in various American countries have recently revealed the surprising fact that the Western Hemisphere is one of the great world areas of malnutrition and hunger. This is surprising indeed, because the rest of the world has always thought of the Americas as continents of abundance, endowed with spectacular natural riches. The legend of El-Dorado, brought back to Europe by the sixteenth-century conquistadors, created the impression of an earthly paradise, with soil of exceptional fertility and a sub-soil pregnant with precious ores. Consequently, it is hard to realize that the immense continental mass that occupies the Western Hemisphere does not produce the food resources needed to supply its own populations. This inadequate food supply cannot be explained on the grounds of an excess of population, since American demographic density is among the lowest in the world. Only Africa and Australia, with their extensive desert areas, have fewer inhabitants per square mile.

It must not be thought that hunger in America is limited to one or two small areas in the poorer regions. Far from it. In all sections of the Americas—northern, central and southern—in the parts colonized by Latins as well as in those colonized by the English, one finds great human masses who suffer the scourge of hunger. Much different from the glowing accounts of sixteenth-century navigators describing the wealth of Mexico, Peru, and other enchanted and fabulous lands, are the sombre reports of twentieth-century investigators describing actual living conditions in the various countries of this continent. There are few bright and shining colours in a present-day picture of the continent of abundance; dark blots of malnutrition and hunger are everywhere apparent.

Both the intensity and the causes of hunger vary from one area to another of the Americas. In order, therefore, to get a clear idea of the overall situation, it is necessary to study the differing phenomena in the various areas. An immediate division may be made between two continental areas with distinct characteristics: English America and Latin America. These two parts of the hemisphere present such well-differentiated features, from their early history down to their current social-economic organization, that hunger has quite different characteristics in each of them. Let us begin with Latin America, where the drama of hunger is more violent and involves a larger number of people: some 90 million individuals, or two-thirds of the inhabitants.

I

Kingsley Davis rightly observed that from a demographic point of view Latin America is one of the most fortunate regions of the world. Its relatively small population inhabits a vast and promising territory—16 per cent of the world's habitable land containing only 6 per cent of the world's population—but the economic position of this region is not nearly so favourable. The aggregate annual income of all the Latin-American republics totals only 10 to 15 billion dollars, while the national income of the United States comes to over 150 billion, more than ten times as much. Seymour Harris estimates that the annual per capita income of Latin Americans averages less than 100 dollars, that is, a tenth of what it is in the United States and an eighth of that in Canada. The standard of living of the Latin American populations, and particularly their grave dietary situation, speak more eloquently of their real poverty than do these overall figures. But the dietary situation is the principal conditioning factor of the insignificant income of these countries. It is a main cause of their insufficient production, of the incomplete exploitation of their natural resources, of their political instability and of their technical and educational shortcomings.

If we look closely at the social structure of this region, we find that most of its ills have their roots in the terrible biological misfortune of chronic undernourishment. The fact that a territory of such great potential wealth is occupied by economically second-rate nations is not a result either of racial inferiority or of disintegrating influences in the environment. The evil is neither race nor climate, but hunger. All through history, it has been hunger that has hobbled Latin-American progress.

The conception of the Latin-American native sitting indolently on his doorstep, contemplating with weary eyes a magnificent landscape of luxurious tropical vegetation which he lacks the spirit and energy to dominate, is essentially a picture of hunger. One can see the Mexican Indian starving on the central plateau of Anauac, where the Aztecs and Mayans enjoyed a régime of plenty. One can see the Peruvian Indian deluding his hunger with a few coca leaves, which he chews all day long to anaesthetize his appetite, occupying the plateau where the Incas, according to reports of the early navigators, terraced the land and produced food in the greatest abundance. Or one can see the half-breed of the Brazilian north-east wasting away on a hunger diet—beans and manioc meal the year round—in the fertile lands of the cane fields, which brought more wealth to the Portuguese of the seventeenth century than all the luxurious imports of the Orient. Everywhere in Latin America is the native with the somnolent air, mourning his hunger and his misery. And when the foreigner, puzzled to see such poverty in the midst of so much apparent natural wealth, speaks to the native and tries to find out why he is poor, he gets answers that puzzle him still more, unless he is aware of the psychological effects of generations of chronic hunger.

Jeca Tatu, a symbolic character of Latin-American fiction, personifies the mental attitude of this land's undernourished inhabitants, broken by lack of nourishment, worm infestation and, frequently, malaria. Shocked at the way Jeca eats the same thing day after day, the foreigner asks: "Don't beans grow in this country?"

"No, *Senhor*."

"Rice?"

"No, *Senhor*."

"Some fruit or other?"

"No, *Senhor*."

Pausing a moment, with his far-away look, to draw on his pipe or turn over a coca leaf in his mouth, the native returns the same answer to all questions: "No, *Senhor*."

But the foreigner, unable to imagine that such well-watered lands, covered with such abundant vegetation, should be incapable of producing food, insists and asks once more: "But have you planted some of these things, to see if they'll grow in this country?"

Then the eye of the half-breed lights up momentarily with a malicious sparkle, and he answers with a certain air of surprise, "Ah! *Plantando . . . dá*." That is, "Of course they'll grow—if you plant them!"

The first impression one gets from this human landscape and this dispirited response is that man does not produce on these lands because of indolence, that he is possessed of a tropical laziness to which the climate of the region condemns the races that live there. But a closer analysis reveals that to call this celebrated tropical apathy the result of climate is an unreal myth. What does exist is an incapacity for activity and a loss of ambition due to ill health, which is in turn a result of the destructive effects of hunger.

When Jeca is well fed he begins to work just as hard and with just as much enthusiasm as does the European farmer in periods of peace and abundance. During a several-year period of heavy internal migration in Brazil, hundreds of thousands of people abandoned the north-eastern area of chronic malnutrition and came to the more prosperous coffee-raising and industrial areas of the south. When they went to work in the fields, the men from the north were incapable of keeping up with the Italian colonists, or even with the better-fed southerners. They seemed a race of good-for-nothings, unable to exert themselves, lacking both will and ambition. But a short period of good nutrition was all that was needed to transform them into magnificent workers. In certain frontier areas of central Brazil, innumerable towns have sprung up and grown like mushrooms, built by the hands of these north-easterners. Those hands were formerly hardly able to move, but they were capable of superhuman efforts once they received the necessary fuel.

This hunger is nothing new. It comes from the past, from the time of the earliest discovery of these lands, and derives from the uneconomical manner of their colonization and exploitation. Although the history of all the countries to the south of the Rio Grande is largely similar, there are many shades of regional coloration. Instead of attacking the question of hunger in Latin America as a whole, it is best to take it up separately in the two component areas, South America and Central America.

2

There is not a single country in South America in which the population is free of hunger. All suffer from this terrible calamity; the only difference is that it is more intense in some areas, more subdued in others. South America can be divided into two parts according to the degree of hunger: an area (A) of extremely defective nutrition, where quantitative hunger is associated with specific qualitative deficiencies in the diet; and an area (B) of less serious dietary conditions, where there is a lack of certain nutritional elements only, and where the diet is in general sufficient in quantity.

Area A embraces three-fourths of the land surface of the continent, and includes the following regions: Venezuela, Colombia, Peru, Bolivia, Ecuador, Chile, the north-east and the extreme south of Argentina, the western half of Paraguay and the northern half of Brazil.

Area B lies in the eastern part of the continent between 20 and 40 degrees latitude, and includes west-central and southern Brazil, that part of Paraguayan territory that lies to the east of the Paraguay River, Uruguay, and the north-east region of Argentina.

The first of these areas includes a large number of well-defined nutritional zones: the corn zone of the extreme north, the manioc zone of the Amazon basin, the mid-continent corn zone, the potato zone of the Andes; the Chaco manioc zone, the corn zone of north-eastern Argentina, and others. In all of these zones we find traditional diets that are insufficient, incomplete, and unbalanced. They are insufficient in calories, unbalanced by an excess of starches, and more or less seriously deficient in proteins, mineral salts, and vitamins.

Caloric deficiency is very widespread, and is apparent in all the dietary zones of this area. Thus, in a study I made before the last war in the region of the Brazilian north-east—an area of cane sugar monoculture—I found an average daily intake of about 1,700 calories. In the Amazon basin, I estimated the daily ration of the rubber worker who penetrates the jungle to collect the crude caoutchouc to be about 1,800 to 2,000 calories. The Bolivian National Nutrition Commission set the average daily diet in that country at 1,200 calories, while the specialists of Colombia and Ecuador estimated the habitual diets of those two countries at 2,000 and 1,609 calories respectively. Investigations carried out in Chile make it possible to conclude that 50 per cent of the country's population does not manage to get 2,400 calories daily, while 10 per cent of them do not even receive 1,500.

All of these figures are alarmingly low, and would represent black starvation if we took as our point of reference for the physiological necessities of human beings in this area the universal standard of 2,800 to 3,000 calories daily. The situation, however, is not actually so tragic. In the first place, as we have already seen, the greater part of this South American area has an equatorial or tropical climate, which, generally speaking, forces down the rate of basic metabolism and the metabolism of labour, and thus brings about a perceptible diminution in the individual's expenditure of energy. Secondly, and again speaking generally, the energy supply of these populations is somewhat higher than the statistics indicate, since the more primitive population groups make habitual use of various food substances the composition of which is virtually unknown to the outside world. For this reason, the specialists take no account of these foods when calculating the energy value of the diet. Again, some of the foods consumed in these countries do not enter into the computations of national statistics because they are produced and consumed locally by isolated population groups which live under semi-feudal economic conditions. It is only thus that the apparent miracle of the survival of these populations can be explained. In spite of the fact that their diet, according to statistical data of production and consumption, is not far from that of a concentration camp, they do not show visible signs of extreme malnutrition.

This is well illustrated by the case of Bolivia. When the Commission on Nutrition estimated the average daily per capita calories at 1,200, it did so on the basis of the food resources of the country, and according to statistical calculations. However, such an extremely low energy intake would condemn the whole region to starvation, and the population to rapid and unavoidable extinction—a condition not borne out by the facts. There can be no doubt that the normal diet of the Bolivian peasant contains food elements not counted by the specialists or registered by the statisticians. Nevertheless, these dietary régimes supply much less than the total energy necessary to cover the daily needs of the individual, even in a tropical area; and we must not forget that many of those who live on this limited diet inhabit cold or temperate zones, such as the Andean plateau or central and southern Chile.

More serious than this quantitative deficiency, to which the organism seeks to adapt itself by reducing its functional expenditures and limiting its normal appetite, are the qualitative deficiencies. The foremost of these is the shortage of those proteins capable of furnishing the amino acids which are indispensable to the growth and vital equilibrium of the organism. The protein deficiency in these regions is very marked, principally on account of the low consumption of protective foods of animal origin: meat, fish, milk, cheese, and eggs. As a matter of fact, the average consumption of such products in this area is among the lowest in the world, well below the desirable minimum. The average per capita meat consumption does not reach 66 pounds per annum, and in certain regions it is much below this. If the consumption of meat reaches an average of roughly 88 pounds in that part of Brazil which is included in this area, it averages 40 pounds in Ecuador, and only 30 pounds in Peru. When we compare these figures with those of better-fed regions, such as Canada, with 132 pounds, or the United States with 130, or the southern part of Brazil with 154 pounds, or Argentine with 300, the inadequate meat consumption of this South American area is thrown into sharp relief.

The average consumption of fish in this area is equally insufficient. Fish has a regular part on the diet of the Amazon region, because of the extraordinary piscatory wealth of that river. The inhabitants of some coastal regions and river deltas are practically amphibian—they make their homes almost in the water, and devote themselves to catching fish and other marine animals. In these cases the protein deficiency is somewhat lessened—a condition which is apparent in their better physical constitution and greater stature—but it does not disappear completely.

The fact is that the usual methods of fishing, as well as the processes used to preserve the product, are very primitive, with the result that the supply of this precious food remains precarious even when the waters are full of fish. In Chile, where the consumption of fish is widespread because of that country's 2,500 miles of coast and tremendous reserves of fish, the per capita consumption is only 11 pounds a year, a quantity obviously insufficient to supply the protein needs of a country that eats little meat and drinks less milk. It is ridiculously small in comparison with the fish consumption of Japan (72 pounds) or even of England (44 pounds). The failure of South America to take advantage of the nutritional wealth of the sea seems less surprising when we learn from F.A.O. data that fishing has never been an important economic enterprise in the Southern Hemisphere. The southern half of the world accounts for only 2 per cent of world production, so that the fishing industry remains almost exclusively an activity of the Northern Hemisphere.

When it comes to milk—that other source of complete proteins—the consumption indices of the countries in this area of South America also reveal an alarming deficiency. In the Amazon region of Brazil the consumption of milk is practically nil—less than 8 quarts a year per capita. In the other countries of the area for which we have statistics, the average consumption is everywhere insignificant: 11 quarts in Peru, 14 in Chile, 26 in Ecuador and 38 in Venezuela. Only in Colombia and Paraguay are the figures somewhat more liberal, reaching 68 and 126 quarts per capita respectively. However, when this is compared with consumption in the United States (110 quarts), or with Denmark and Switzerland in normal times (164 and 263 quarts respectively), one sees that milk is a very precarious source of proteins in this section of South America. The figures on the consumption of cheese and of eggs are also very low in comparison with other nations. An investigation carried out in 1938 by Dr. Baldo in Venezuela revealed that in the rural districts of the interior, 50 per cent of the children get no milk at any time during the year, 59 per cent eat no meat, and 89 per cent eat no eggs. In the Brazilian north-east, my own study revealed that only 19 per cent of the families investigated used milk, while there was practically no consumption at all of cheese and eggs.

In this area the normal sources of protein are usually corn, beans, and certain tubers and roots, none of which possess the proteins of high biological value capable of furnishing the organism with all the requisite amino acids. In this whole area, there are only a few population points in which animal proteins make up half of the total protein in the diet.

The first biological expressions of protein deficiency in this area are retarded growth and subnormal stature, symptoms displayed by a majority of the population at all stages of life. In Bolivia, where the protein deficit is considerable, children are born markedly under weight. According to Professor Luis Sotelo, former director of the Department of Nutrition in La Paz, 60 per cent of the children born in that city weigh less than 6 pounds at birth (whereas the normal figure is 6¾ to 7¾ pounds). In addition, 35 per cent of these children are clearly subnormal in stature. According to anthropological measurements made by Morris Steggaerda, the average height of the population groups in this area is among the lowest on the American continent.

Many other consequences result from this relative deficit in proteins, though they do not show themselves as openly as they do in those regions of the Far East or Central America where the deficiency is almost absolute. The diarrhoeas, and the partial or complete hunger oedemas, so common in areas where nutrition is based almost exclusively on rice, as in China and Indo-China, or on corn, as in Mexico, are clinical rarities in South America, where dietary monotony is always modified by the use of a variety of nutritional elements. What is common in this area is the appearance of nutritional diseases in children, the etiology of which certainly includes deficiencies of proteins as well as of other nutritional elements. According to a report presented before the First Latin-American Conference on Nutrition, 73·3 per cent of the inhabitants of the city of Lima, capital of Peru, present clinical symptoms of this type. In the Brazilian north-east, the children of the poorer classes, who seemed to be in a good state of nutrition and weighed more on an average than children of the well-to-do classes, were found by laboratory test to suffer from hidden protein deficiencies; the percentage of proteins in their blood was clearly out of balance, and their greater weight was simply due to a greater retention of water, a dropsical condition of the tissues which precedes the stage of visible oedema.

In contrast to the low proportion of proteins is the exaggerated proportion of carbohydrates in the diet of these people. It is the starchy foods—cereals, tubers and roots—which are most widely consumed in this geographical area, and in many cases several of them are included in one regional diet. This extreme abundance of carbohydrates far overbalances the quotas of proteins and fats. Diets containing more than 80 per cent carbohydrates are common. This nutritional unbalance is a decisive factor in the high incidence of beriberi and occult deficiencies of vitamin B_1 in this area, which occur even when the supply of this vitamin appears to be adequate. It cannot be assumed that there is a greater expenditure of vitamin B_1 in tropical climates, as was long thought to be the case, nor that there is an exaggerated loss of this nutritional element through abundant sweating. It is simply that the heavy load of carbohydrates to be metabolized requires a proportionately greater intake of vitamin B_1. When this is lacking, a condition which might be called relative avitaminosis appears, a vitamin deficiency resulting from a lack of balance in the vitamin B_1-carbohydrate index.

On the mineral deficiencies, the most common are shortages of calcium, iron, and iodine, and in the lowlands—regions of heat and humidity—a shortage of sodium chloride. The prime factor in deficiencies of this type is the mineral poverty of the majority of tropical soils, as a result of which the plants in this area generally have a lower mineral content than similar species cultivated in other and richer types of soil. In addition, most of the people in this area eat very few green vegetables and fruits, and the poorer classes eat hardly any. The alimentary tradition of the Iberian peoples who colonized these lands has been completely abandoned. Their diet was rich in greens, fruits, and vegetables—the refined and delicate products of intensive garden and orchard culture which was introduced by the Arabs into the Iberian peninsula and transmitted to the Portuguese and Spanish. Today, in these South American countries, fruits and greens are hardly ever seen on the table of the factory or farm worker. There are even widespread taboos against the use of fruits, popular prejudices that limit their use even when economic conditions would permit it.

Calcium deficiency is general throughout the area, and includes all social classes: the average consumption is less than 50 per cent of the 0·80 grams daily recommended by nutritionists. In the Brazilian north-east one finds a daily calcium intake of about 0·40 grams, and a similar amount was found in the diet of Colombia. Dr. Santa Maria, Professor of Nutrition at the School of Public Health in Santiago, Chile, estimates the daily consumption of this mineral in his country at 0·49 grams per capita, while the nutritionist Emma Reh, through the magnificent researches carried out in Paraguay, came to the conclusion that the per capita calcium intake in the capital of that country was some 0·29 grams a day, and in a rural section (Piribebuy) 0·36 grams.

In spite of these alarmingly low calcium rations, rickets is a clinical rarity throughout the greater part of the area. Even in the Amazon, where the daily calcium consumption drops to 0·26 grams, there is practically no rickets. The rarity of this disease in tropical-equatorial regions is today a universally recognized fact. We know that Dr. Rigoberto Aguillar, examining 10,000 children of the Mexican plateau, found various kinds of nutritional deficiencies but not a single case of rickets—even though he used clinical methods, including X-ray, capable of detecting its hidden symptoms. The same is true of Porto Rico—one of the most acute starvation areas in the Americas—where Dr. Lydia Roberts found no trace of rickets among the undernourished children. In the area of South America which I am discussing, rickets appears on a socially important scale only in Chile, and there its greatest incidence is among poor children in the south of the country—well below the tropic zone. These regions lack the abundant sunlight of the countries to the north, where the wealth of vitamin D formed by photosynthesis in the skin prevents the appearance of rickets, even though the diet is deficient in calcium.

If rickets is rare, dental caries is, in compensation, of telling frequency. The only groups to escape tooth decay are certain Indians such as those of the Bolivian uplands; they have magnificent teeth, but we are at a loss to explain the reason for this physiological superiority. In Chile both the Indian and half-blood populations suffer from a high incidence of dental caries; in school children it runs from 40 per cent to 75 per cent. In the rural areas of Paraguay Miss Reh observed that "an adult with good teeth is rarely seen. The young people always have teeth missing, and most of the aged are completely toothless."

Another deficiency that weighs heavily on the health of South Americans is the lack of iron. In the majority of the South American dietary zones the food does not supply the 10 to 15 milligrams of iron necessary to the daily constitution of the haemoglobin pigment. The direct result of this deficiency is a very widespread kind of hypochromatic, microcytic anaemia. The so-called "intertropical hypoemia" held by tropicalists at the turn of the century to be an immediate consequence of tropical climates is simply an anaemia due to iron deficiency, and therefore of nutritional origin.

In many tropical and equatorial countries, worm infestation is so heavy and common that it is an important contributing factor in deficiency anaemia. Intestinal worms rob the blood and hinder the absorption of nutritive elements. According to a report of a former minister of public health in Bolivia, 98 per cent of the Bolivian population are carriers of intestinal parasites. According to the data of the Rockefeller Foundation, the incidence in Venezuela is 95 per cent.

In Bahia, a city of north-eastern Brazil, nearly 40 per cent of the school children were found to be suffering from anaemia. When a supplement containing iron was added to their diet, the anaemia rate dropped in four months to only 3 per cent, confirming the fact that a deficiency was the cause of the disease. In places where this evil is most intense, one finds the strange phenomenon of geophagy, or geomania, the habit of eating earth. This custom, in my view, represents a state of specific hunger. An analysis of the clays that are eaten as food in Brazil confirms the fact observed by Cobert in Tunisia, and Batz in the Congo—they are for the most part clays which contain high proportions of iron salts.

Endemic goitre and cretinism caused by iodine deficiency appear in various sections of this area, all far inland and separated from the coast by mountain barriers. Here the soil and water are extremely poor in this metalloid. The countries most subject to endemic goitre are Paraguay, Bolivia, Ecuador, and Argentina, although the others suffer from it more moderately. In Brazil there is a high rate of cretinic goitre in the southern region which is a part of Area B, and will be dealt with later.

In Paraguay Miss Reh found that the incidence of this disease among the students in 35 different towns was 28 per cent. In the Itá region the figure rose to 79 per cent, while other parts of the country, such as Santo Inacio, were below the national average. In Bolivia the evil is endemic in all provinces; the worst conditions are found in Chuquisara, where some 90 per cent of the population is affected. In the Pichincha and Babura provinces of Ecuador, goitre is found in 70 per cent of the inhabitants, and among school children of certain localities the incidence is 100 per cent. Another great goitre area is north-east Argentina, where iodine deficiency is associated with innumerable other deficiencies. This, in fact, is one of the worst starvation areas of South America, with 80 per cent of the children, according to Ramón Cáriano, showing evidence of malnutrition. It is also a zone of high alcohol and coca consumption, factors which also contribute to the organic decadence caused by cretinic goitre.

In all of these places the victims of this disease show obvious signs of physical and mental degeneration: abnormalities of growth, endocrinous dwarf conditions, partial and general deformities, deaf-mutism, feeble-mindedness, idiocy, and so forth. This, then, is one of the most serious deficiency diseases, capable of causing the complete degeneration of whole groups of the population.

The deficit of sodium chloride may be said to be general throughout the lowlands of the continent's tropical zone, where the hot and frequently humid climate necessarily leads to excessive sweating and to an extreme depletion of the organism's salt reserves. If one recalls that every quart of sweat contains 2 to 3 grams of salt, and that on the hottest days a person may sweat as much as 8 or 10 quarts, it will be seen that there is a daily loss of around 20 grams of sodium chloride.

In certain regions, such as the Brazilian north-east, the use of salt meat, salt fish, and other sources of sodium chloride attenuates the loss from perspiration and prevents the appearance of this particular deficiency. In other zones, however, such as the Amazon, where the consumption of salt is insignificant, the deficiency is a permanent problem. In fact, the Indians throughout the Amazon basin hardly use salt at all; their favourite seasoning is pepper. This dietary unbalance leads to a drop in the sodium content of the blood and bodily liquids, and to a compensatory increase in potassium. The nutrition deficiency thus sets up a syndrome in the humours of the body which causes states of nervous depression and muscular exhaustion. The factor of sodium deficiency almost always has a place in the etiology of tropical fatigue in this area.

The problem of sodium hunger is of the highest social and economic importance for people in tropical and equatorial regions. It involves not only climate, but racial relations and cultural habits as well. As we have seen in surveying the various forms of hunger, Talberg's researches showed that clothed skin secretes sweat almost twice as rich in salt as does naked skin. According to Graham Lusk this is a decisive argument against the use of clothing in the tropics.

Yet white men, except for the Portuguese, have continued to wear clothes in the hottest climates. Not only have they been ignorant of the advantage of stripping; they have also feared to expose their pale and pigmentless skin, since it is easily penetrated by harmful rays as well as beneficial, by heat as well as ultra-violet. The Negro, however, is protected from burns and sunstroke by his pigmentation. In Caribbean or Brazilian cane fields, or on North American cotton plantations, wherever he works, in fact, the Negro goes nearly naked. And, losing less salt than the white man, he tires less easily.

The variations of sodium and potassium metabolism provide a logical interpretation of several aspects of South American life. They undoubtedly account, at least in part, for the white man's well-known failure at physical work in the tropics, and thus for his sedentary, bureaucratic functions and his exploitation of Negro and Indian labour. They also demonstrate how a trait representing racial superiority in polar regions may come to signify inferiority in hot countries, and vice versa, supporting the anthropologists' findings that there are no biologically superior or inferior races.

In this instance, the question is not mainly one of biological differentation, but rather of the external process of acclimatization, depending on the customs of the groups concerned. Thus the details of diet, of clothing and of work organization take on great significance in connection with a scientific exploration of sodium deficiency; these details have made themselves felt throughout the structure of tropical life.

The use in this zone of South America of restricted and, to a certain extent, monotonous diets, limited to only four or five food substances throughout the year, gives the specialist in nutrition an impression, at first glance, that a spectacular variety of vitamin deficiencies will be found there. But repeated investigations of the nutritional state of the people of various South American countries contradict that assumption completely. This is not to say that such diets really furnish the requisite quantities of vitamins, nor that they could possibly be called balanced diets. They are usually lacking in vitamins, but the shortage is only partial, so that the organism does not reveal the deficiency in typical clinical symptoms, in frank vitamin diseases.

Only in limited areas and under exceptional conditions do the typical vitamin deficiency diseases appear, either in endemic or epidemic form. The restricted quantity of the diet as a whole, and also, to a certain degree, the wide consumption of various spices and sauces made from native plants serve to forestall the more acute states of deficiency.

The lack of fats, of milk, of butter and of green vegetables in the customary diets of this area necessarily leads to a certain shortage of vitamin A. Nevertheless, conditions such as xerophthalmia or keratomalacia, eye conditions that reveal this deficiency, are clinical rarities that appear only sporadically. The reason for this is that each area has certain local resources capable to some extent of supplying the organism with this vitamin. In the Brazilian north-east, for instance, the *mestizo* populations use large quantities of oil of *dend* (*Elêais Guineensis*) a palm brought from Africa which produces an oil containing on the average 1,000 units of betacarotene per cubic centimetre. And in Argentina any vitamin A deficiency is corrected by the widespread use of *maté*, a beverage which has a high content of this element, as analyses carried out under the direction of Professor Pedro Escudero have demonstrated.

Vitamin A deficiency makes itself felt most frequently through retarded growth and through skin disturbances—hyperpigmentation and hyperkeratosis—of the sort observed by Frazer and Wu in certain parts of China.

Although in the manioc, corn, and rice areas, there is an insufficient supply of those elements which make up the vitamin B complex, the typical deficiency diseases such as beriberi, pellagra, and the conditions due to lack of riboflavin are rare. There was a large-scale epidemic of beriberi in the Amazon basin during the rubber boom from 1870 to 1910. During this period, the productive energy of the region was completely and exclusively absorbed in the latex harvest, with the result that fresh food disappeared entirely.

As rubber rose to represent for a time 28 per cent of Brazil's total exports, a great flood of immigrants was attracted to the Amazon. They came in waves, adventurous spirits attracted by the mirage of sudden wealth, seeking the "black gold", the priceless latex that spurted like blood from gashed rubber trees throughout the Amazon valley. The virgin forest made these pioneers, who tried to snatch this wealth from the breast of the tropical jungle, pay dearly for their daring. And her favourite vengeance was beriberi.

A majority of the hard frontiersmen who took part in the rubber rush were struck down by the terrible disease. Most of them came from lands of the Brazilian north-east and were dazzled by the abundance of water in the Amazon region. They usually arrived in good health and full of enthusiasm. They plunged into the jungle along the rubber trails. They bled their trees and collected the precious milk. They smoked their rubber. They sold the product for a fabulous price. And then, just when victory seemed assured, they began to feel the ground falter beneath their feet. Their legs grew weak and lifeless, and a drowsiness crept upward from their feet and into their vitals. A constriction in the chest seized them like a mighty claw. It was beriberi coming on, taking possession of their bodies, gnawing at their nerves, and putting an end to vitality. The woodsman who had travelled hundreds of miles on foot, who had come like a conqueror, overcoming all obstacles, along interminable trails, rivers, and inlets, was powerless against the terrible onslaught of beriberi. Then came the swellings, the terrible dropsy; the skin of his arms and legs stretched tight and shiny, oozing lymph. Or his body dried up, the muscles wasted and the flesh melted magically away as though the disease were eating him alive.

No statistics are available to give the precise number of victims. We do not know exactly how many were left as pitiful remains sunk in the swamps of the Amazon, or how many came back disabled, carried down the river in litters to gentler lands and milder climates, where they might get over their beriberi and forget as best they could their ill-starred dreams of wealth. But from the chronicles of the period, one concludes that at least one-half of the migratory population of the Amazon fell victim to this dietary deficiency.

The cause of the epidemic, which cost so many lives and which became one of the principal reasons for the failure to consolidate the Amazon economy during the rubber boom, can be traced to very definite social and economic factors. The fundamental causes were, in fact, strictly economic. Following the discovery of the vulcanizing process, the price of rubber in world markets reached fabulous figures; and as the quotations continued to rise daily, the whole population of the Amazon, permanent as well as temporary, forgot everything else and concentrated its whole energy on harvesting the precious latex. Fishing was paralysed, herds were abandoned and left to drown in the floods, agriculture came to a stop for lack of workers; and this drying up of all the local sources of wealth led to a tremendous crisis in the regional diet. It came to be made up almost exclusively of dry foods, and of canned goods imported from abroad. The diet of the rubber worker consisted of jerked meat, corned beef, dried beans (usually old or wormy), manioc meal, polished rice, canned preserves, sugar, chocolate, and alcoholic drinks imported from Europe.

With this improper diet, completely lacking in fresh foods and very similar to that of the old sailing ships on which beriberi took a heavy toll, it is no wonder that an outbreak of beriberi followed. Then, after doing its terrible work, seemingly indifferent to all the medical and hygienic resources mobilized against it, the epidemic suddenly, and for no apparent reason, ceased—at least for no reason that could be explained by the medical knowledge of the times, which considered it to be a contagious and infectious disease. At the very time that Brazil's rubber monopoly ended, when the cultivated plantations of the Far East forced the Amazon's native product off the market, when the price of rubber collapsed and depression closed in, forcing the dealers into bankruptcy and the regional economy into collapse, the beriberi, as though it had been nourished by this bonanza economy, also began to decline.

When the cycle finally came to an end, with rubber exports dropping to one per cent of national export volume, beriberi disappeared completely from the rubber region. When there was no more money to burn, no more cash to buy expensive drinks and English corned beef, the man of the Amazon had to go back to what he had been doing before the boom—to his hunting and fishing, to his harvesting of roots and wild fruits, to his incipient agriculture. The farming was only rudimentary, but it was enough to supply a few fresh products: corn, green and string beans and other vegetables which, along with the wild products, greatly improved the quality of his diet, overcame the vitamin deficiency and put an end to the beriberi.

In this way the cycle of the terrible disease came to a close, recalling in many ways the epidemic of scurvy in Alaska during the gold rush. Scurvy was one of the symptoms of gold fever just as beriberi was a symptom of rubber fever. Today, only a few small foci of endemic beriberi remain in South America: in the delta of the Orinoco, in Venezuela and in certain zones of sugar cane monoculture, where it is called "sugar disease" or "plantation sickness".

In the Brazilian corn belt pellagra is practically unknown, because the cereal is always eaten with milk and a little meat. In Venezuela, on the other hand, and in the north-east of Argentina, pellagrous skin lesions are much more frequent. In Bolivia the diets of 90 per cent of the population are deficient in vitamins, but in spite of this fact, Dr. R. Passmore, an expert of the International Children's Emergency Fund, examined hundreds of children without finding a single case offering clinical evidence of A, B, or C vitamin deficiency. The situation is different with the latent or hidden cases, the symptoms of which are lack of appetite, fatigue, anaemia, and so forth. These are extremely common.

Both scurvy and rickets are rare on the South American continent. Children with clear signs of rickets are found only in Chile, with its cold and temperate climates, and in the Bolivian highlands. According to Dr. Passmore, rickets in Bolivia is limited to children less than a year old; they recover spontaneously as soon as they begin to walk and to expose their skins to the ultra-violet rays of the sun.

Such, in rapid strokes, are the principal characteristics of the eating habits and the state of nutrition of the human groups that inhabit this one geographical zone. Now let us take a look at conditions in the second South American area.

In Area B, nutritional conditions are definitely better than in the area of chronic hunger, but they are still far from perfect. This relative dietary superiority has many causes. In the first place, this is the richest part of the continent, where the greater part of its economic activity is concentrated. The sector of Brazil included in this area, although it represents only a third of the national territory, includes 80 per cent of the nation's economic capacity, and produces more than 50 per cent of the food consumed in the country. The part of Argentina included in this area, the so-called humid pampas of the littoral, takes in only 21 per cent of the land area of the nation, but in it are concentrated 68 per cent of the population, 82 per cent of economic activities, and 85 per cent of the agricultural production of the country.

The per capita production, buying power, and living standards of this area, which includes all three of the great industrial cities of South America—Buenos Aires, Rio de Janeiro, and São Paulo, each with a population in the millions—are a great deal higher than in the sectors included in Area A. Per capita production in southern Brazil, for example, is ten times higher than it is in the extreme north. This area includes the most developed transportation network of the continent, and the populations enjoy a higher educational level—both of which factors are of great importance in maintaining a rational diet. Then too, the soil and climate of this area are superior both for farming and cattle raising. The continent's great herds of cattle, sheep, and swine are concentrated here.

This complex of favourable factors rules out any quantitative deficiency in the regional diet. A study carried out in Rio de Janeiro before the last war established an average daily consumption of some 2,800 calories. Escudero estimated the average consumption of Buenos Aires factory workers at 3,000 calories a day.

Another aspect of relative superiority in the diet of this area is the much higher consumption of protective foods. Meat consumption varies among 154 pounds in the south of Brazil, 244 in Uruguay, 253 in eastern Paraguay, and 300 in Argentina. The average milk consumption is 143 quarts in the Prata countries, somewhat less in the Brazilian sector. The average consumption of fruits, on the other hand, is higher in the south of Brazil (143 pounds) and more moderate in Argentina (130 pounds), Uruguay (106 pounds), and Paraguay (66 pounds). It is easily seen from these figures that protein deficiencies must be exceptional in this area; they are limited to the more miserable inhabitants of the city slums, who are in fact a marginal population.

When it comes to the supply of minerals and vitamins, the situation is less favourable. In many sub-areas there are partial deficiencies of calcium, iron, and iodine, as well as of the A and B groups of vitamins. The existence of these is substantiated by a number of facts. In an investigation carried out in 1933-34, covering 50,000 school children in Buenos Aires province, it was observed that 81 per cent suffered from dental caries. Ten years ago the Argentine Senator, Alfredo Palacios, revealed to his colleagues that 30,000 children in Buenos Aires were unable to attend school because of malnutrition. In a study made in Uruguay by Dr. Bauza, it was found that out of 5,000 children from 17 departments of the country, 21 per cent showed unquestionable signs of undernourishment. And if rickets is exceptional in the tropical zone of the continent, it appears with great frequency in this temperate area. Thus in Uruguay, according to Carrano and Bazzano, 15 per cent to 18 per cent of the children admitted to hospitals in Montevideo showed signs of rickets.

The most spectacular deficiency to be observed in this sector is the lack of iodine. In all the territory of Brazil west of the Serra do Mar mountain range, endemic goitre occurs in high proportions. Alvaro Lobo observed an incidence of 44 per cent among the school children of a municipality in Minas Gerais and in the neighbourhood of the city of São Paulo, Arruda Sampaio found that the figure was 60 per cent.

It may be seen from this outline that the alimentation in all parts of both South American areas is more or less seriously defective. This general nutritional deficiency is one of the reasons, beyond a doubt, for the physical inferiority of the populations that inhabit this continent. The high index of general mortality and of infant mortality, as well as the high index in these areas of certain infectious diseases such as tuberculosis, are in the final analysis indirect manifestations of chronic malnutrition. The general mortality indices of South America are twice as high on the average as those of North America. The figures of infant mortality are among the highest in the world: 277 per thousand in Bolivia, 335 in the north-west of Argentina. In South American countries, tuberculosis almost always stands first among the causes of death, and in certain zones it reaches a figure that is 10 times as high as the average death rate from tuberculosis in North America.

What is responsible for this alarming nutritional situation in South America? Is it possible that the land is overcrowded, and the starvation due to overpopulation? Far from it. I really do not know on what William Vogt based his statements when he asserted that all the South American countries, excepting only three or four, are overpopulated. The truth of the matter is that South America has an extremely low demographic density. A population of only 90 million inhabitants is scattered over an area of more than 7 million square miles. This is a relative density of only 13 to the square mile—I believe, among the lowest in the world.

If hunger is not due to excess of people, is it perhaps due to the absence of soils suitable for agricultural production? Again, no. It is true that South America is no Ukraine or American Midwest, spectacularly fertile, but neither is it a barren Sahara. The greater part of the South American continent is covered with soils tending to tropical laterite, and this limits their use to the cultivation of plants that produce carbohydrates: sugar cane, manioc, corn and rice. It is true that the yield from tropical soils is almost always lower than that from land in temperate regions: a hectare of land in Brazil produces an average of 2,200 pounds of corn and 3,300 pounds of rice, while a similar area in the United States yields 3,520 pounds of the one and 4,890 pounds of the other, and in Italy 3,520 pounds and 10,120 pounds respectively. In addition, tropical soils are extremely subject to erosion, and this rapidly leads to a decline in productivity. The climate of South America, moreover, which has too much rain in areas such as the Amazon, and too little or too irregular a rainfall in others—such as the semi-arid Brazilian north-east, the coastal areas of Ecuador and Peru and the region of the Atacama Desert in northern Chile—makes agriculture somewhat difficult in a large part of the continent.

But the limitations imposed by these natural factors are far from making necessary or justifiable the existence of undernourishment and hunger. There is not a single large expanse of land in the world that does not have its waste areas, so much so that in the world as a whole, less than half of the land can be put to use. Although they may be scattered and irregularly distributed, a great many areas of very good soil are to be found in South America. If these soils were cultivated, they would be capable of producing sufficient food for a population many times greater than South America has today.

It is estimated that at least 25 per cent of South America could be cultivated for one purpose or another, but the land in use at the present time does not exceed 5 per cent of the total area. The F.A.O. has found that in spite of its low demographic density, South America has only 1·5 acres in cultivation per person, as against 4 in the United States and 2 in the U.S.S.R. It is clear that social factors, rather than natural factors, are responsible for the precarious and insufficient food supply of the continent.

The prevailing starvation in South America is a direct consequence of the continent's historical past. This history is one of colonial exploitation along mercantile lines. It developed through successive economic cycles the effect of which was to destroy, or at least upset, the economic integrity of the continent. There were the cycle of gold, the cycle of sugar, the cycle of precious stones, the cycle of coffee, the cycle of rubber, the cycle of oil. And during the course of each of these cycles, one finds a whole region giving itself up entirely to the monoculture, or mono-exploitation, of a single product—at the same time forgetting everything else, and thus wasting natural wealth and neglecting the potentialities of regional food supply.

The one-crop culture of cane sugar in the Brazilian north-east is a good example. This area once had one of the few really fertile tropical soils. It had a climate favourable to agriculture, and it was originally covered with a forest growth extremely rich in fruit trees. Today, the all-absorbing, self-destructive sugar industry has stripped all the available land and covered it completely with sugar cane; as a result this is one of the starvation areas of the continent. The failure to grow fruits, greens, and vegetables or to raise cattle in the region has created an extremely difficult food problem in an area where diversified farming could produce an infinite variety of foods.

Another phenomenon intimately associated with the kind of colonial land exploitation which aims at the production of cash crops for export is the latifundium, or great estate. One-crop agriculture and the latifundia constitute the two greatest evils of the continent; they are terrible handicaps to its agricultural development and consequently to its food supply. A few statistics on landed property in some of the South American countries are sufficient to make the situation clear. In Buenos Aires province, with a population of 3,500,000, a handful of only 320 aristocratic families monopolizes about 40 per cent of the land. In another province of Argentina, Santa Fé, there are 189 great estates, each with an average of 62,000 acres. In the central valley of Chile, where the bulk of the country's agricultural production, as well as 80 per cent of its population, is concentrated, the latifundia remain unshaken. In Curico province, 437 great plantations take up 83 per cent of the land, leaving only 17 per cent of the province for 5,937 small proprietors.

Brazil, with the same population as France and an area fifteen times as large, has only half as many individual properties (1,900,000 in Brazil as against 4,000,000 in France). There is a reason for the fact that only 2 per cent of the territory of Brazil is under cultivation, and only 1 per cent of it devoted to the production of food.

Since food production in each country is limited almost exclusively to a small area, there is a lack of regional balance. In conjunction with this, the problem of food supply in South America is greatly aggravated by the lack of means of communication between these separate economic islets. To these main causes may be added others, such as ignorance of the simplest nutritional hygiene on the part of the people, and the wave of inflation that has followed the Second World War. All these factors help to preserve the deplorable nutritional situation that prevails in the region.

3

Because of its geographical position and strategic importance, Central America has been called the "American Mediterranean". But if we consider the living conditions of the people, "American Balkans" would be a more appropriate title. The Balkans have always had the lowest living standard in Europe, and on the New Continent this honour goes to Central America. Many natural and cultural factors, down through the ages, have conspired to make the nutritional problems of Central America more difficult than those of South America.

For the purposes of this study, "Central America" is taken to mean all of the lands between South America and the United States, including both the continental republics and the whole Caribbean archipelago that used to be known as the West Indies. A study of this Balkanized region from a dietary point of view throws a bright light on the obscure history of the conflicts, the revolutions and social agitation that have kept it in turmoil and seriously retarded its progress.

Though all these countries situated on the rim of the Caribbean have certain common characteristics that make it appropriate to include them in one geographical area, this unity does not stand up when they are looked at from a nutritional standpoint. In order not to force the facts and over-simplify, two definite sub-regions must be considered separately: the continental mainland, and the area of the Antilles.

In the continental zone, which extends from Panama to Mexico, one finds an extremely deficient diet based upon corn. From prehistoric times, corn has been the principal dietary element of the native populations that inhabit this region. It was on the basis of this cereal that certain autochthonous cultures, such as the Maya and Aztec, rose to high stages of development; while the excessive, practically exclusive, use of corn was the principal reason, according to certain authors, for their early decay.

Corn is not a plant that carries a curse condemning those who feed upon it to irremediable decadence, as Bulnes has said. It does not contain a poison, as was thought for a long time because the groups who eat it suffer so frequently from pellagra. Corn is a valuable food, and surely constitutes one of America's most important contributions to civilization and to the world. Unfortunately, however, it is not a complete food, and cannot supply the organism with all the essential nutritional elements. Its proteins are limited in quantity and quality. When consumed along with other protective elements corn is an excellent complementary food, but it cannot nourish the organism adequately when it is the only source of proteins, mineral salts, and vitamins.

And that has been just the trouble in Central America. The diet there is the most monotonous of the continent, consisting exclusively of corn, beans, rice, peppers, a few roots and tubers, coffee, and sugar. There are some zones in which the monotony is even more deadly, where groups of natives eat corn almost exclusively, either as cakes (*tortillas*) or as gruel (*atole*). According to Dr. Francisco Miranda, former director of the Mexican Institute of Nutrition, the diet of the Mexican peasant in certain areas consists of three tortillas in the morning, three tortillas at noon, and three at night.

This narrowness of diet, analogous to the Chinese concentration on rice, has serious nutritional results. It is no wonder, therefore, that investigations made in this area have revealed a striking amount of the most varied kinds of deficiency. The worst and most widespread is probably protein deficiency, which results from the total, or almost total, absence of meat, milk, cheese, and eggs from the diet of Central American farmers and workers. Dr. Epaminondas Quintana, studying the dietary problems of the Caribbean, calls attention to the fact that the peasant of Guatemala, even though he may keep a milk cow and a few chickens, invariably sells the milk and eggs so as to buy corn and whisky. The same thing happens in Mexico, according to the evidence of the anthropologist Ramos Espinosa: "The milk, chickens, or eggs are sold at a low price by the humble folk, who then spend the money so obtained on *pulque* or whisky."

Among the vitamin deficiency diseases, the most common are pellagra, beriberi and the ophthalmias resulting from lack of vitamin A. Deficiencies of iron and iodine are the most serious shortages of minerals, manifested respectively by the anaemias so common in this area, and by the endemic goitre that ravages entire populations in the mountainous parts of Central America. Calcium shortage is avoided by the traditional practice of softening corn for tortillas with lime, and possibly also by the local excess of sunshine, especially on the high plateaus where the sun is particularly favourable to the production of vitamin D. By the side of this healthful corn cookery, unfortunately, we find another habit that is extremely harmful, that is, the practice of boiling food in several waters, and throwing out the water with rich content of mineral elements. In this connection Dr. Quintana observes that "throwing out the *nixtamal* water, in which the corn is cooked, results in a lamentable loss of phosphorous."

In certain areas such as the Republic of Salvador, in addition to the specific deficiencies one finds a tremendous energy deficit, with populations living on an average of about 1,500 calories a day. This absolute starvation diet led Vogt to refer to the tragedy of the Salvadorean people as a "parabola of misery".

The incidence of dietary deficiencies in both children and adults is among the highest in the world. Thus in 1944, when Dr. Rogoberto Aguillar examined 10,000 poor children in a dispensary of Mexico City, he found 5,000 with clear signs of dietary deficiency. The same pediatrician noted that the height of the children was much below normal, the stunting of growth from starvation amounting in some cases to alimentary dwarfism. Many children of ten or twelve appear to be no more than four or five years old. When I visited Mexico in 1945, I had occasion to observe, in the company of this doctor, innumerable cases of vitamin deficiencies in children, and I was greatly impressed by the extreme frequency of pellagra. Dr. Aguillar explained to me that this results from the fact that the poorer mothers are so underfed themselves that they have no breast milk for their babies; the children receive instead a gruel made of corn and beans, and this soon produces the terrible splotches of pellagra. Dr. Alfredo Ramos Espinosa, studying the diet of adults in Mexico, showed that alimentary deficiencies are excessively frequent, and the agrologist Medieta y Nunez states that starvation is endemic in various parts of the country.

One of the most serious consequences of this chronic hunger of Central American peoples is their notorious apathy—their traditional indifference and lack of ambition. This depressed psychological state has been considered by many to be a kind of racial melancholy, but one of its causes is surely the chronic starvation to which these human groups have been subjected since before the time of Columbus. This state of chronic hunger with its shortages of certain vitamins begins by dulling the appetite; and when the native no longer suffers physical hunger as a result of lack of food, he has lost the strongest stimulus in the struggle for life—the drive to eat.

There is no question but that these hungry populations no longer feel genuine appetite; they eat mechanically, as though eating were a duty. This point is made by a great many different investigators, who have been shocked at how little food—a tortilla with chile, and a swallow of pulque—will satisfy an individual in this starvation area. Even for so light a meal, the native must stimulate his diffident appetite artificially, using, or rather abusing, stimulants and appetizers. "In this way," according to the anthropologist Ramos Espinosa, "he produces a reflex flow of saliva, which takes the place of that resulting from a good appetite."

The multi-deficient diet throughout Central America and the chronic starvation that results are in a sense an inheritance from the indigenous pre-Columbian culture, although the situation has since been aggravated in many respects by the shortsighted methods of colonial exploitation. When the Spanish invaders came into contact with the various native groups, a diet based on corn was already in use. Students of the subject, piecing together a picture of the habits of that period, consider this diet to have been obviously deficient in proteins and in other essential nutritive elements. The Indian cultivated his corn on *milpas*, or burned-over tracts in the forest, and as soon as the land had been worn out by rapid erosion, he moved to another tract. Some insist that such an agricultural system based on stripping the soil, in regions generally mountainous and therefore subject to erosion, was the fundamental reason for the decline of the great American civilizations, such as the Mayan Empire, that flourished some twenty centuries ago in what is now Guatemala.

Others hold that the decadence resulted, not from exhaustion of the soil, because the population at that time did not by any means occupy the whole highland region, but from the monotony of a diet permanently short of good proteins. The fact that the Indians of this area raised no animals whatever is a sign that it must have been practically impossible for them to get a sufficient supply of animal proteins. They could still hunt, to be sure, but a large part of the plateau was semi-arid, and wild animals were never plentiful there; and besides, the needs of a relatively dense population can hardly be supplied by hunting alone. Human groups that live by the fortune of the hunt are always widely dispersed within their geographical area, as are the Eskimos and the Pigmies.

In order to survive on so precarious a basis, the Indians, led by instinct (or as we would now say, by a variety of specific hungers), turned to the oddest kinds of natural resources. But such resources were adequate in only some areas. A Mexican anthropologist has called attention to the singular fact that at the time of the discovery the only two really powerful kingdoms remaining in Mexico—the Aztec and the Tarascan—were both located on the shores of large lakes, the Texcoco and the Pátzcuaro. These lakes constituted great reserves of food of animal origin. The groups living on their banks were thus able to improve on the regional diet and to survive longer than other groups such as the Mayas and Toltecs, who had been prey to progressive biological and economic decline.

In the works of classical Mexican historians on the early days of the Spanish conquest—such authors as Sahagún, Torquemada, Diego Duran, Clavijero—one can see the ingenuity of the Indians in wringing from the lakes the resources they did not know how to obtain from the land. Thus these historians relate that they ate all kinds of fishes, frogs, shellfish, insects, water birds and other inhabitants of the waters. "They even ate the foam off the water," says Clavijero, referring to certain species of light blue algae that floated on the surface of the lagoons. Clavijero also reports that the Mexicans ate large quantities of the eggs of a fly—*axayaatl*—which were deposited on the surface of the water like a gelatinous scum. This delicacy, known by the name of *ahuauhtli*, was a kind of indigenous caviar. The Indians also ate the flies themselves, reduced to a paste and cooked on leaves of corn. It is evident that such aquatic foods, though seemingly repugnant, would nevertheless be good sources of proteins, as well as of mineral salts and vitamins.

Consequently, we must recognize that the prehistoric Mexican diet was not so deficient as it seems at first glance. This supposition is supported by the facts that Mexican chile pepper is an excellent source of vitamin C, and that *pulque*, though it may be harmful on account of its high alcoholic content, furnishes appreciable quantities of the vitamin B complex. It may be assumed, then, that some Indian groups at least succeeded in maintaining a balanced diet by means of food habits that experience had taught them. Contact with the white colonizers, rather than improving the situation, made the regional diet a great deal worse.

Although Spanish colonization in Central America was not so dramatically destructive for the native as it was in the Antilles, nor so inhuman as English colonization in this same area, it had a terribly upsetting effect on the economic integrity of the region. The first exploitation was strictly destructive; it was aimed primarily at minerals, and pushed all other productive activity into the background. The discovery of the mines had an evil effect on the incipient colonial economy not only of the continent, but throughout the Caribbean area. In the Antilles, where a promising beginning in agriculture had been made, practically all the white colonists abandoned their fields and rushed off to the mines. The historian, Gonzalo de Reparaz, has said: "Once the American mesas were discovered and their great mineral wealth brought to light, the Antilles were depopulated of Spaniards, and the native races began to disappear. Thus, half a century after the arrival of the white man in the tropics, his efforts at colonization could be said to have miscarried."

The cultural shock involved in contacts with some of the more advanced groups also tended to depress the agrarian economy and to worsen living conditions in the region. Following the royal instructions of the Emperor Charles V, his Spanish agents first put the Indians in chains, and then forced them to work under conditions of practical slavery in the mines and sugar mills, and on the indigo and coffee plantations. But the Indians were in constant rebellion against this bondage; they often abandoned their lands and thus disrupted the whole regional economy.

The food supply was also greatly upset in this area by the diversion of the land of primitive Indian communities to huge tracts or latifundia, which were conferred upon individual colonists and then allowed, for the most part, to stand idle. Another factor that helped in definitively ruining the native populations was the one-track exploitation to which almost every region was dedicated: some were given over to mining, others to coffee planting, some to tobacco and others to cacao. This specialization brought on the deformed economy which is still found in such countries as Salvador, which produces practically nothing but coffee, and Honduras, which exports nothing but bananas. In this unilateral exploitation of the earth's resources, the great plantation owners concentrated all the available labour on their own monopoly activities. The result was an exaggerated ecological unbalance that destroyed the soil of the region as well as its living complement, and led to the decline of the original inhabitants.

Thus the disruptive aspects of injudicious colonialism, rather than excess population, exhausted the sources of regional food supply. The Central American republics, taken as a whole, are far from having an excess of population that would in any way justify the precarious nutritional situation to be found there. Their population density is about 30 individuals to the square mile. This is higher than of South America, but is still far sparser than the world's really overpopulated areas, or even those of median density. It is only in Salvador, with its limited territory and its concentration of 140 inhabitants per square mile, that the theorists of neo-Malthusianism can find some basis on which to argue that the misery of the people is due to a supposed excess of population. In the rest of the area the problem is not excess, but shortage of people, particularly of healthy people capable of the organized and rational development of the region's potential wealth. In a country like Costa Rica, with 10,000,000 acres of arable soil, most of it volcanic in origin and extremely fertile, only 10 per cent of the land is currently under cultivation, and of this, a third is devoted exclusively to coffee.

Soule, Efron and Ness state that a monopolistic system of control of the land and its natural resources is still in force today in the great majority of Central American countries. Mexico alone, thanks to her revolutionary leaders, succeeded in carrying out radical agrarian reform. Here, under a system known as the *ejido*, which is very similar to the primitive Indian community, the latifundia were broken up and the land returned to the peasants.

The *ejido* was undoubtedly a step forward for Mexico in the struggle against hunger, but unfortunately, the results fell short of expectation. The Mexican revolutionists were idealists rather than technicians, and they forgot that a mere redistribution of the land is not enough. In order to cultivate it adequately, technical and financial resources are also necessary. The result was that the Indians, who were generally unprepared, disorientated, and without adequate technical knowledge, were unable to make proper use of the plots they received.

The agrarian reform did not lead to the increase of production or to the indispensable diversification of crops which were needed to raise the national living standard. As proof of this, one may cite the fact that even today Mexico imports appreciable quantities of her basic food element—corn—and still does not have adequate supplies of many protective foods. As documentary proof that Mexican land reform did not lead to the expected improvement in the nutrition of the people, I quote the following from the report sent by Dr. Calvo de la Torre, of the Mexican Institute of Nutrition, to the First Latin-American Conference on Nutrition, held at Montevideo in 1948: "The peasants were confused and upset by the change of régime. Their number has increased, but the land produces no more than it did some years ago. The diet becomes ever more slender, and the people continue in poverty."

Certain measures have been taken in recent years that tend toward a wider dissemination of technical knowledge among the Indian masses and toward a large-scale use of irrigation in the semi-arid zones. It is very possible that by such steps, including the introduction of certain sanitary, economic, and educational measures, all linked to the plan of rural recovery, the country may be able to obtain an appreciable increase in production, and an equal improvement in the living standards of her native population.

Central America is still in the grip of extreme social unrest, struggling to free herself from the pitiless yoke of malnutrition and hunger, and from the unfortunate economic factors that are responsible for it. Attempting to explain this situation, Vogt states—and this time he is absolutely right—that "the Spanish tradition imposed upon the Indian tradition and reinforced by the modern competitive system, has resulted in one of the most vampirish, extractive economics existing anywhere in the world today."

4

Even worse than the living conditions in the continental part of Central America are those that prevail on the long chain of islands that stretches across 1,500 miles of ocean, from the tip of Florida to the coast of Venezuela. In this sub-area of the Antilles are found some of the hungriest, most underfed masses in the whole Western Hemisphere. This is surprising if one recalls that these islands, when they were discovered in the fifteenth and sixteenth centuries by Columbus and other navigators, dazzled the eyes like precious gems and gave promise of incalculable riches. And indeed it is no wonder that these islands with their luxuriant tropical vegetation, the priceless "Emerald Necklace of the Antilles," mounted like dark green stones in the blue immensity of the ocean, should have remained for more than two centuries, to quote from *Lands and Peoples*, "the constant lure and inspiration of sailor adventurers from almost every European port . . . the fame of the rich islands attracting fortune hunters of all kinds."

Four centuries after their discovery, these promised lands lie plundered and despoiled: a large part of their soil is exhausted, much of their forest is destroyed, and their people are underfed and debilitated. To the eyes of present day sociologists, the jewels of the Antilles look more like paste—their brilliance dulled and their mounts tarnished. Even the richest gem in the necklace—Cuba, the "Pearl of the Antilles"—has suffered from a succession of social and economic crises, a result of the destructive exploitation of a soil that has been exhausted and enslaved by one-crop farming.

The fundamental causes of this rapid plunder of the Antilles were the same as those observed in other zones of tropical America. The only difference is that the destructive process is more obvious here. A rapid review of the colonial history of the islands reveals clearly enough the secret of their economic degradation. The Antilles were discovered by Spaniards, but their possession was soon disputed by other European peoples, including the French, English, Dutch and Danes, and they became a storm centre of colonial struggle and unrestrained plunder by the pirates and freebooters of the time. Agricultural colonization was begun on some of the islands, with diversified subsistence farming, but the discovery of gold and silver on the mesas of the continent led to the abandonment of such routine economic activity in favour of the eager and adventurous search for sudden wealth in the mines.

One very important element in the impoverishment of the area was the European colonizer's almost total destruction of the native population. Although we still do not have sufficient data to estimate with any accuracy the population of the islands at the time of discovery, there is no doubt that they were heavily populated. Padre Bartholomeo de las Casas estimated the early population of Hispaniola (Haiti and the Dominican Republic) at 3,000,000, while Baron Humboldt thought the population of Cuba to be about 1,000,000. The historian Lopez de Velasco relates that sixty years after the discovery, these indigenous populations had been practically wiped out, and nothing remained but a few scattered tribes lost in the depths of the jungle. By the end of the sixteenth century, the millions of the original natives had been reduced to about 15,000.

To take the place of the Indians, who were quite unco-operative and even went so far as to prefer death to slavery, the colonizers proceeded to import African Negroes, by which means they repopulated the islands and carried on their agricultural exploitation. "One Negro can do as much work as four Indians," said the colonizers of the period, and so Africa, the great reservoir of slaves, became the source of supply for colonial labourers.

Thus the plantation system was set up, based on great estates and slave labour, and after a short and fleeting period of dubious splendour, it dragged much of the region down to ruin. There are those who attribute the greater part of the social ills of the area to the importation of slaves, and to the type of culture that went with it. The use of slaves, however was not a cause, but an inevitable result of the kind of colonial exploitation that was undertaken. One of the chief prerequisites of the plantation system was a cheap and abundant supply of labour. Since the Indian declined the role, the only alternatives were to import labourers from other parts of the world, or to give up the colonial system itself, which would have meant abandoning an adventure that might well bring the colonizer all sorts of wealth and honours.

This colonial system of soil utilization and land tenure contains the germ of that defective economic organization which has brought the human groups of the area to their present precarious situation. The product chosen as the basis of the economical exploitation of the region—sugar cane—also had a decisive effect on the future of these people. C. K. Meek is undoubtedly right when he states that the type of product often determines the character of the tenure: "Some forms of cultivation can best be carried out on a plantation basis with the assistance of outside capital." Now it happens that sugar cane is the sort of product that most encourages exclusive monoculture, great plantations, and even the practice of absenteeism—in which capitalists merely finance the monopolist enterprise, without ever appearing on the scene. Such an economic situation soon developed in most of the Antilles, which were devoted almost exclusively to the cultivation of this plant, with its evil individualism and its almost morbid hostility to other vegetable species. It is an extremely demanding plant; it forces soil and human beings into slavery, because only in a régime of total slavery can the sugar cane economy show a profit. The Portuguese, Spanish, French and English, without exception, bowed to the demands of sugar cane, and received the guerdon of their servitude. For colonial sugar was worth more to Portugal than the spices of the Orient, more to Spain than the gold of Peru, and worth as much to the English as the profitable traffic in African slaves.

American sugar, then, was a goodly inheritance for the colonizing countries; but the countries that were colonized received only under-nourishment and starvation as their share. It is one-crop sugar farming that is responsible, in spite of a relatively fertile soil and a climate favourable to agriculture, for the chronic starvation of the peoples of the West Indies.

The subsistence problem is extremely serious and difficult of solution today because of the high population density of the area. This is the only sub-area in Latin America, in fact, where one can speak of the danger of overpopulation. The average density, for instance, is some 157 people to the square mile, while in certain islands the figures are truly alarming. In Porto Rico there are 546 individuals to the square mile, and in Barbados 1,192. This sub-area also has the highest index of population growth—about 2·03 (the rest of the Central America reaches only 1·88, and South America 1·63). It is clear that this high demographic concentration is, on one hand, largely a product of sugar cane monoculture with its labour demands, and on the other, of chronic starvation, acting as a factor favouring population growth.

In studying the problem of alimentation and hunger in the Antilles, we should not lose sight of the fact that some of these islands were colonized and held by Latin peoples, and others by Anglo-Saxons. For the moment, therefore, I will treat only the islands colonized by Latins—the Spanish and French—and leave the others for separate study in a section dealing with hunger areas in English America.

The people of the Latin American Antilles, whether in independent countries like Cuba, Haiti, and the Dominican Republic, or in colonies such as Martinique and Guadaloupe, still exist on a predominantly vegetable diet, based upon starchy tubers, beans, rice, plantains and sugar cane derivatives, including alcohol. This is clearly a defective diet; there is an excess of carbohydrates in the manioc, yams, and sweet potatoes—all basic foods of the region, and a deficiency of protective elements. According to a report presented by Dr. Fernando Milanez to the First National Food Conference of Cuba, in 1943, such foods as meat, milk, eggs, greens and vegetables are a rarity on the table of the peasant of that region. Only occasionally does he get a piece of dry meat—*tasajo*—or some fruit. And this happens only in one period of the year, during the sugar harvest, when work is to be had, and when there is some money for expensive foods. In the slack period, the so-called *tiempo muerto*, consumption is reduced to little more than tubers and a certain amount of cereal, or in some areas of absolute monoculture, to what Soule, Efron and Ness term "a diet of sweet potatoes and cane juice."

The same types of deficiency we have discovered in other areas of America occur here among both urban and rural populations, and there are, in addition, certain deficiencies, such as tropical sprue, which are characteristic of this zone. The country people suffer most, because they usually sell all the products of the land in order to get a little money. It is a notable fact that though the Cuban peasant eats hardly any fruit, a great abundance of tropical fruits may be seen in the markets of Havana. They come in all shapes and colours, giving the impression of an area of optimum nutrition. But these fruits, unfortunately, are consumed by only the tiny minority that is able to buy them. These appetizing and succulent fruits piled up in the Cuban markets are both evidence and denunciation of those factors that lead to widespread starvation in a zone so well constituted by nature to feed its inhabitants abundantly.

Let us take Cuba as a characteristic example. No island is better able to provide for the dietary self-sufficiency of its population. Three-quarters of its surface is made up of level, arable land; great stretches of it consist of red clay soils of considerable depth and demonstrated fertility. Such conditions would make possible the most productive kind of diversified farming, a type of agriculture that would provide enough and to spare for the 100 inhabitants that occupy each square mile. However, a system of one-crop farming for the export of products such as sugar and tobacco was begun in colonial times and later expanded. This practice, supported financially and carried to the extremes of monopoly by United States capital (50 per cent of the capital in the Cuban sugar industry comes from the United States), has brought the Cuban population to a terrible state of malnutrition.

Oswaldo Patino's study of the nutrition of the Cuban factory worker, carried out in 1939, revealed extreme nutritional poverty. A family of five was living on a daily energy total sufficient for only one person. Dr. Fernando Milanez, in the work just referred to, stated that, "more than a third of the population does not have sufficient buying power to obtain an adequate diet," and added that, as a consequence, the most varied types of dietary deficiency run riot on the island. Another student of the problem, Dr. Antonio Clerch, the Cuban delegate to the First Latin American Conference on Nutrition in 1948, presented a report to the meeting that ended with the following words: "One often sees various types of nutritional deficiency diseases in the hospitals, but the commonest are the protein deficiencies with their characteristic symptoms of edemas and other changes due to hypo-protein states; the vitamin deficiencies A, B_1 C_2, D: rickets, osteoporose, osteomalacia, macrocytic anaemias, epidemic goitre, tooth conditions, and other deficiency diseases."

More or less similar conditions prevail on the other islands of the Caribbean Sea. Some are a little better off; in Hispaniola, for example, the abolition of the latifundia in Haiti, and the relative tendency to polyculture in the Dominican Republic, help to relieve the situation. Some, such as the French possessions, Guadaloupe and Martinique, are in a worse state.

The Antilles suffered greatly from the plantation system during the colonial period, but after certain of the islands gained their independence another factor appeared, which helped to prolong an economic régime unfavourable to the biological interests of the population. This factor was the economic influence of the United States, or as it was called at the beginning of the century, "dollar diplomacy." Because of the weakness of the Central American countries, there was thought to be a danger to the United States if one of them were to fall under the domination of another great power. The United States, therefore, attempted to maintain absolute control in this area, and even went to the extreme lengths of using force and of resorting to military occupation in order to protect the interests, or to impose the will, of Washington. The United States looked upon the tropical lands of Central America as a kind of necessary complement to its temperate zones, and for a long time it pursued a policy in this area almost identical with that of the English in Africa. It was a policy exclusively aimed at the strategic and economical defence of empire interests. The United States' policy, imposed by force, of support to the great landowners held back the social evolution of many of these countries to a marked degree, and thus contributed toward keeping them in a state of poverty. At the same time, the Central Americans developed a spirit of suspicion with regard to the *gringo* which has added greatly to the difficulty of genuine collaboration in the interest of the two Americas.

This deep-rooted distrust is very similar to that shown by the African peoples when they are confronted with the promises and initiative of the English. But as a result of the "Good Neighbour" policy of Franklin Delano Roosevelt it has been somewhat dissipated. The important point is that American technical proficiency, which could have done so much to improve the food supply of Central America, has always been checked by political and economic interests, and as a result has contributed little or nothing.

5

The parts of the American continent that were colonized principally by the English are the United States, Canada, Newfoundland and Labrador, British Guiana, British Honduras, and a series of islands in the Caribbean—Jamaica, Trinidad, Tobago, Barbados and lesser islands. Most of these places are somewhat better off, nutritionally, than the areas settled by Latins, but that is by no means true of all of them. In certain spots of British America, dietary conditions are extremely precarious; in fact, some of the British West Indies "lead" the whole American continent in human malnutrition.

Even the inhabitants of the better fed areas, such as the United States and Canada, are a long way from escaping completely the effects of nutritional deficiencies. Although no masses of human beings in these regions of more balanced economy are exposed to outright starvation, we must nevertheless record the existence of certain specific deficiencies which have an unfavourable effect on the health of these peoples. Hunger, open or concealed, extends throughout the enormous land mass that stretches from Alaska to Tierra del Fuego.

A few cases will suffice to prove that no nation or geographic area on the American continent is entirely free from the perils of hunger and malnutrition. In such great cities of the United States as New York and Chicago, there is a great deal of rickets among children, the result of a relative deficiency of vitamin D and of certain mineral salts. A series of surveys carried out during the last ten years in various Canadian cities showed that a large part of the population does not receive the minimum nutritional elements that dietary specialists consider indispensable. Thus, a survey made at the beginning of the last war in Halifax revealed that a third of the families checked suffered from deficiency of proteins and iron. Further, half of them were not getting enough phosphorous and vitamin A, and more than half were not receiving enough vitamins B_1 and C. In Quebec too, the diet was shown to be somewhat deficient, particularly in the A, B, and C groups of vitamins, and the B_1 deficit was truly alarming. A report from Toronto, finally, came to the following conclusions: "There is a widespread deficiency of vitamin B_1, and the quantities of vitamin C available cannot be regarded as adequate. Marked deficiencies of calcium and iron were found in the food consumption of women, and of calcium among teen-age girls."

In another British dominion—Newfoundland—nutritional conditions are a great deal more difficult, and the deficiencies appear as definite clinical symptoms. A survey made there in 1944 and repeated in 1948 by a group of outstanding experts in nutrition revealed multiple dietary deficiencies among the population of this island. Deficiencies in the vitamin A and B groups had diminished in the interval between the surveys, illustrating the success of certain measures recently taken by the dominion government, but the second survey showed that deficiencies of vitamin C had at the same time grown much more serious and widespread. Typical scurvy may no longer be seen in Newfoundland as it was in the past, but a high percentage (41 per cent in 1944 and 54 per cent in 1948) of the individuals examined revealed definite vitamin C deficiency by a reddening and swelling of the gums.

These people are inadequately fed, but they are not grossly starved. There are, however, two regions of British America where whole populations suffer real starvation, These typical areas of intensive, mass hunger are the British West Indies, and the old plantation region in the south of the United States.

6

"British Failures in the West Indies" is the title of a chapter from the great work by Grenfell Price, *White Settlers in the Tropics*, in which this outstanding geographer analyses the progress of British decadence in the Antilles. In describing the disintegration and degradation of the colonial populations, he assigns a decisive role to improper nutrition. The dietary régimes of these islands have been extremely inadequate throughout their history. They are much like those of the Spanish Antilles; they result from the same soil and natural environment, and from the same type of preponderant economic exploitation—the one-crop culture of sugar cane.

They are all predominantly vegetable diets, with an excess of starchy foods in the form of cereals, roots, and tubers. Such protective foods as meat and milk have practically no part in the alimentation of the people. Within this framework, each island has its own characteristic local variations. Thus in Jamaica the staple foods are yams, sweet potatoes, cassava and breadfruit, while in Trinidad the principal foods consumed are polished rice, dry peas and coconut products. In Barbados, where the food situation is truly alarming, the normal diet is rice, sweet potatoes, yams, onions, tea, and sugar. Sometimes a little codfish or salt pork may be included. The menu of this island never includes milk, eggs, or fresh vegetables. English nutritionists report that babies are weaned at three months, and fed from then on with tea and corn meal gruel thickened with rice or potatoes.

The notorious defects of this sort of diet are greatly aggravated by a custom that is general among the local populations—the habitual use of alcohol in excess. Many years ago, William Rippley wrote that a Sunday of rest killed more people on these tropical islands than a whole week of backbreaking labour on the plantations, because Sunday was a day of drunkenness that undermined the health of whole populations. Grenfell Price has more recently described the effects of excessive use of alcohol in this area: "Drunkenness was prevalent and gambling a consuming vice. Many a young West Indian immigrant of good family drank himself to death. Friends notified his parents he had died of 'fever' and that good old whipping horse, the tropical climate, took the blame." The association of an extremely defective diet with the abuse of alcoholic drinks persists today, and this is a combination of terrible potency in the degradation of colonial peoples.

It is not surprising that health conditions are wretched on these islands, and nutritional diseases very frequent. The heavy rate of infant mortality and the high incidence of dental caries, tuberculosis, and infectious diseases in general, are signs of a lack of organic resistance on the part of these populations. Pellagra, beriberi, and the xerophthalmias are often encountered on one or another of the islands. In Jamaica, cirrhosis of the liver in children is of a frequency unheard of in other parts of the world. There, too, there is a great deal of the fatty liver disease so thoroughly studied by Dr. J. C. Warterlow, who considers this illness an unquestionable sign of undernourishment.

The shortage of food and the deplorable nutritional conditions in the British West Indies are direct results of the defective system of colonial exploitation developed by the British in this area. The system rested on the one-crop culture of sugar cane with an exclusive and monopolistic concentration without parallel in the monoculture of any other crop, and even without parallel in the culture of sugar cane by any other colonists. The story of this area is the most vivid example in economic history of how a group of human beings, moved by greed for immediate profits, can destroy the natural wealth of a highly endowed region and reduce its people to misery and starvation.

Nowhere else in the world did the sugar economy evolve with such velocity, quickly reaching its peak of splendour and passing immediately into hopeless decadence. V. T. Harlow, in his excellent book, *A History of Barbados*, makes clear the process of social-economic decline on that island—a decay which, because of the distinctness of its phases, provides a good illustration of the course of English colonial policy in the Antilles.

Harlow's data and documentation indicate that, at the beginning, the settlers of Barbados relied on polyculture; the land was divided into small holdings and devoted to cotton, tobacco, citrus fruits, cattle and hogs and other subsistence products. During this first phase of the island's history, between 1625 and 1645, the English population grew rapidly, as the following figures show:

Year	*White Population*
1628	1,400
1638	6,000
1643	37,000

But with the development of cane-growing in the middle of the seventeenth century, the diversified agriculture was gradually strangled, the small properties were swallowed up by the plantations, the island's food reserves became progressively more scanty and the life of the colonists more difficult. This retrograde economic revolution led to a general exodus of the whites, and the demographic curve started downward:

Year	*White Population*
1667	20,000
1786	16,000
1807	15,500

The white population remains at about 15,000 today.

As sugar cane culture developed, slaves took the place of the whites in agricultural labour. The slave-owning plantation economy grew, rose to a transitory splendour that lasted from 1650 to 1685, and fell into decadence. By this time the island was already worn out. Forests, once so dense that it had been hard to find an open space in which to build the first settlement, were completely razed; subsistence culture had come to a halt, and sugar itself was economically ruined because it could no longer be produced at prices to meet the sharp international competition. Such is the fleeting history of sugar in Barbados, as told by Harlow and confirmed in general outline by other responsible historians.

What happened in Barbados was repeated in the other islands. Jamaica, Trinidad, Tobago, arrived by the same steps at the same dénouement, only not quite so quickly. Just a few years after the beginning of English settlement in the Caribbean (which started on St. Kitts, in 1623) the colonists had begun the process of monopolizing the land, setting up plantations, and organizing the planter caste, a "cruel planter aristocracy tyrannizing over a poverty-stricken mass of enslaved white servants," said Grenfell Price. In order to carry out their plans of large-scale production, this sugar aristocracy was forced to import Negro slaves, since the white population soon starved to death or fled the country.

Thus the typical slave-holding plantation régime was established. As living conditions became more difficult under the pressure of this economic system, the income from sugar declined to such a degree that the English parliament, considering this trade the most important element of overseas commerce at the time, decided in 1737 to investigate conditions in the colonies and to try to remedy the situation. When the Special Commission made its report to Parliament, it emphasized the significance of inadequate diet in the decadence of the islands. The report as quoted by von Lippman read, in part: "The feeding and treatment of the slaves (418,000 Negroes as against 82,000 whites) and as a result, their working capacity, leaves a great deal to be desired. Only 25 shillings a year is spent on feeding a slave with an estimated value of 50 pounds."

The report was correct. The planters were interested in the slave only as a machine, and they consequently limited his alimentation to the bulk fuel necessary to keep him going. These bulk calories could be supplied by the cheapest foods: manioc meal, sweet potatoes, yams, and rice. Of this kind of food, and of this kind only, the Negroes enjoyed a certain abundance. The planters imagined that by filling the bellies of the Negroes with starchy, high-energy foods, they were feeding the sugar industry itself and, by means of the Negro labour machine, transforming low-cost foods into sugar that was worth its weight in gold. Neither the report to Parliament, nor the complaints and revolts of the slaves, resulted in measures adequate to improve the situation in the islands. On the contrary, living conditions grew worse and worse.

With the revolt in 1776 of the North American colonies, from which the British Antilles were accustomed to receive the greater part of their food supply, the situation became absolutely desperate. Where there had been chronic hunger there now appeared outright starvation—famine itself. It is said that on the island of Jamaica alone, between 1770 and 1777, at least 15,000 Negroes starved to death. When this widespread distress, including the danger of mass starvation of Negro slaves and the consequent loss of the capital tied up in them, began to threaten the interests of the dominant class directly, the British Empire for the first time took steps to improve the food supply.

Among the measures adopted one in particular, because of the strange adventure it led to, has become a part of world history and legend. By order of His Britannic Majesty, the good ship *Bounty* set out for Polynesia in December, 1787. Its mission was to get breadfruit seedlings from Tahiti for introduction in the West Indies. This plan for Caribbean relief grew out of the stories circulating in England about the providential Polynesian tree which Captain Cook had discovered on his various voyages to the South Seas.

The *Bounty*, under the command of Captain Bligh, remained at Tahiti until April, 1789, at which time, having filled its hold with breadfruit seedlings, it sailed off across the southern seas for Jamaica. Then came the mutiny, and the subsequent abandonment of Bligh, with 18 men, in a lifeboat. The mutinous crew proceeded to establish themselves on deserted Pitcairn Island, which they populated with a race of English-Tahitian halfbreeds; Captain Bligh and those who had remained faithful to him, after 3,618 miles of wandering, were saved and returned to England. In spite of the disastrous results of the first expedition, the project seemed so important to England that a new expedition was organized and entrusted to the same Captain Bligh, who succeeded this time in introducing breadfruit into the British West Indies.

Anything so simple as the introduction of a new plant was a long way from remedying the situation in the islands. Breadfruit perhaps improved the food supply somewhat in times of famine, but it could not correct any of the permanent nutritional deficiencies. Captain Cook had reported that by planting a few of these trees a whole family would have food enough for the rest of their lives, but the truth is that the breadfruit tree alone was not responsible for the Tahitians' magnificent physiques, which made such an impression on the first European navigators who put in at these paradisiacal islands. The health and resistance of the Tahitians were the result of a diversified diet, abundant in fish, innumerable fruits and green vegetables, and of clothing and shelter intelligently adapted to the climate in which they lived. Although Captain Bligh succeeded at last, and the Negro slaves of the West Indies began to have breadfruit alongside their potatoes and yams, they still lacked protective foods, and still they died of malnutrition.

Emancipation of the slaves was approved by the English Parliament in 1833. It was thought in some quarters that the freedmen might return to diversified, subsistence farming in the African tradition, and that their living conditions might improve. But nothing of the sort happened. The great landowners felt the foundations of their plantation system crumbling, and they erected a thousand obstacles to keep the free Negro from growing his own food. They carried their obstructionism to the point of putting prohibitive taxes on lands devoted to food production, and thus they managed to shackle the slaves anew, and force them to continue working on the sugar plantations for starvation wages. In order to keep wages down, the planters proceeded to import labourers from the poorest areas of the Far East, and in a short time East Indians were replacing Negroes on all sorts of jobs. Their diet was made up almost exclusively of rice, their needs were few, and thus they were admirably suited to the demands of the sugar oligarchy, whose interest in cheap and abundant labour accounts for the fact that much of the present population of British colonies in the American tropics is of Indian origin. There are 168,000 East Indians in British Guiana, out of a total population of 380,000; and in Trinidad, 200,000 individuals out of 560,000 are Hindus.

In Jamaica, this system of disguised slavery brought about a sharp reaction. The Negroes took possession of abandoned lands in the interior of the island and set up autonomous societies based on subsistence agriculture. This movement resulted in a definite improvement in the local food situation, and even today, Jamaica has better dietary conditions than the other British colonies of the Caribbean. Although the children suffer from deficiencies which I have mentioned, the adults enjoy better health than the Negroes of the other islands. In the report published in 1939 by the Committee on Nutrition in the British Colonial Empire we find that: "The generally strong physique, good humour, contentment, and patience of the Jamaican Negro labourer are regarded by some as evidence that the nutritional conditions are not seriously at fault."

If the Negroes had been able to exert as great an influence on the economic régime and dietary habits of other American regions as they did in Jamaica, it is very possible that conditions of alimentation in this continent would not be so defective as they are today. But their influence was slight, and the nutritional situation of the Antilles continues to be one of the worst in the world, with hunger stalking the slums, urban and rural, of these ravished lands.

7

There is one small island in the great reaches of the Antilles which deserves special attention. It boasts, according to a team of outstanding American experts, Soule, Efron and Ness, the worst and most dangerous nutritional conditions of the whole Caribbean area. This is Puerto Rico, a very black spot on the map of universal hunger.

Within approximately 3,400 square miles Puerto Rico contains a population currently estimated at two million. And on this crowded little island there has been staged one of the most dismal dramas of hunger ever seen in the Western Hemisphere. The fate of Puerto Rico was unlike that of the rest of the Antilles; its tragedy did not develop through the errors of the old colonial system of the great European powers. It is due, instead, to the utter failure of the modern methods of commercial exploitation practised by the land of free enterprise, the great American power of our day.

When the United States took possession of Puerto Rico in 1898, following the victory over Spain, it found a population which, if not exactly swimming in wealth and abundance, was far from the misery and hunger that it suffers in our times. The ensuing catastrophe is worth analysing in detail.

Puerto Rico, to the Spanish, had not looked very promising in terms of sugar raising. It is an extremely mountainous island, with a comparatively irregular surface. The only level land is a narrow strip along the coasts. Its first impression on the Spaniards who discovered it in 1493 is indicated by a passage in Columbus's memoirs, in which he tells of reporting his discovery to Queen Isabella. She asked what the island was like, and Columbus crumpled a piece of paper in his hand. Laying it on the table, he said, "Your Majesty, it is like that."

The Spaniards quickly brought sugar cane culture to this crumpled countryside, but the industry developed neither the size nor the intensity that characterized the colonial exploitation of islands with soil better adapted to the cane plant. Large-scale sugar monoculture, with its typical régime of great landholdings and slavery, did not exist during the Spanish tenure of Puerto Rico.

Because of this agricultural difference, Puerto Rico never lost its white colonists. The British Antilles came to be almost exclusively inhabited by Negroes, but in Puerto Rico there were large contingents of Spanish settlers, principally from Galicia and the Asturia, to balance the Negro population. Puerto Rico still has a population more than two-thirds white.

Nor, until the end of the last century, was the land monopolized by great plantations. Until the time of the United States' occupation, 75 per cent of the arable land of the island was broken up into small lots containing an average of 12 acres, devoted in the main to subsistence crops. The United States Military Census Commission reported in 1899, immediately after the occupation, that, "This general ownership of farms has unquestionably had a great influence in producing the contented condition of the people of this island, as contrasted with the restlessness of Cuba, where a large proportion of the cultivated area was in the hands of comparatively few landlords."

It is true that the sugar industry flourished, at the expense of the Negro, on the low lands along the coast; but in the central areas, large numbers of small farmers carried on subsistence agriculture. When the United States took over, there were 250 small, farm-sized sugar factories on the island, and 20 centralized mills.

Profound changes were soon brought about. Small growers were swallowed up by great plantations with their centralized production, and practically disappeared. Through the agency of United States' capital, the sugar industry fell under the monopolistic control of a small but powerful group of absentee owners. At the same time, it expanded enormously, and came to be the axis of Puerto Rico's whole economic life.

In the period between the two world wars, sugar cane plantations occupied 40 per cent of all the cultivated land of Puerto Rico. Cane sugar accounted for some 60 per cent of the island's total exports. Great aggregations of capital owned tracts of 40 or 50 thousand acres, and these took up the most fertile zones of the country. Before the last war, four of the largest organizations produced half of all the sugar of Puerto Rico.

The commercial exploitation of the territory, however, was not limited to sugar production. On the lands not adapted to sugar raising, American capital undertook to raise tobacco and coffee, both export products. Thus nearly all the island was converted to supplying the United States. Huntington presents the following figures concerning land use in Puerto Rico in the years before the last war: "240,000 acres are devoted to sugar, 190,000 to coffee, and over 50,000 to tobacco, but only about 160,000 to corn, beans, and sweet potatoes or yams, the three main subsistence crops. Taking all the land into account, the Puerto Rican crops raised primarily for export occupy between three and four times as large an area as those devoted to food for home consumption."

It is no wonder, then, that in order to feed her population, and to feed them badly at that, Puerto Rico has had to import great quantities of food, at prices above the purchasing power of the bulk of her inhabitants. The blame for this critical situation belongs in great part to the United States. As the American geographer, Preston James, very properly emphasized, "Far from showing the way to a stabilized economy, the United States has provided an unhappy example of commercial exploitation of land and labour by absentee owners."

The United States points with pride to what it has accomplished in a material way for an ancient and poverty-stricken Spanish possession. And indeed, since Puerto Rico has been under the protection of the star-spangled banner, there have been considerable accomplishments, such as the building of good roads, beautiful palaces like the Capitol at San Juan, and a model university. But these mean little, in the balance of colonial accomplishment, in comparison with the misery in which the Puerto Rican people are forced to live—stark misery that led the investigator Eric W. Zimmermann to state that they constitute, "probably the largest single group of destitute people under the American flag."

Prevented from producing the food she needs, and forced by customs restrictions to import it from the most expensive source in the world (60 per cent of food imports are from the United States), Puerto Rico has been dragged into the labyrinth of a dead-end economy. Preston James expresses this untenable situation very well: "In no small part the poverty of the majority of the people is due to the fact that Puerto Rico is included behind the tariff wall of the United States. For while this economic position of Puerto Rico makes possible the profitable production of such commodities as sugar, tobacco, and fruit in competition with places outside of the United States, it also makes it necessary for the Puerto Ricans to purchase whatever they do not produce for themselves in the world's most expensive market. Not only must the Puerto Ricans help to maintain the relatively high standards of living achieved by industrial labour in the United States, but also they must support the higher wage scale of American seamen, since the goods are brought to the island in ships which fly the flag of the United States. The tariff increases the distinctions between the prosperity of the producers and the poverty of the rest of the people."

The economic policy of the United States has been based on the protection of an insignificant minority at the cost of bitter sacrifice by the majority of the native population. This state of striking economic unbalance led an American nutritionist, N. C. Shermann, assigned to study the island's dietary situation in 1930, to state that he had never seen any place in the world, "where the profits of a rich land go into so few pockets (largely those of absentees) and the people who work the land are not only kept so poor in money, but also so inadequately fed and housed . . ."

Living conditions in Puerto Rico have been growing progressively worse, as the Zimmermann report showed, partly because of the concentration of human beings that has developed. The demographic density is currently calculated at 574 individuals per square mile of surface, which corresponds to about 1,500 persons per square mile of cultivated land—an agricultural density among the highest in the world. However, although this density of population may aggravate certain aspects of the food problem and make it more difficult to solve, it cannot be considered the cause of the existing chronic starvation.

Actually, the undernourishment, and overpopulation, are symptoms or consequences of economic disorganization—of the defective economic setup, and of the unrelieved commercial exploitation. It was the sugar industry that determined the high demographic concentration, just as it did in all the other areas of sugar monoculture. We have proof all over the world—in Java, in Barbados, in Louisiana—that sugar culture can only develop and prosper on the basis of a dense rural population. Even in Brazil, where the demographic density is low, the area of sugar cane monoculture in the north-eastern states is one of the most heavily populated zones of the country.

In Puerto Rico the hunger of the cane fields for human hands plus the chronic hunger of the labourers gave rise to an impetuous increase in the population of the island. In spite of a shocking mortality index, particularly as regards infants, the population has doubled since the United States occupation.

Food conditions in Puerto Rico reached an extremely perilous state during the last war, when imports became exceedingly hard to get. The country was carried to the brink of famine. Hill and Noguera reported that when the war broke out, Puerto Rico "depended entirely on outside sources for fats and oils, cereals and preparations, and imported 89 per cent of the fish and 60 per cent of the legumes it consumed." With imports paralysed, there followed a veritable panic among the population; the situation became so bad in 1944 that some 40 per cent of the inhabitants were registered for relief.

The habitual diet of the island is composed of beans and rice, starchy vegetables, and codfish. The lower classes, however, cannot afford codfish, and, on the other hand, the higher classes use meat and eggs. But among all classes, the basic diet is monotonously the same—beans and rice, rice and beans. An analysis of the usual diet of this people reveals serious deficiencies of proteins, mineral salts, and vitamins. The low nutritional level is immediately manifest in the underdevelopment of the children, who are always greatly inferior to the growth standards of the United States. Xerophthalmia, scurvy, tropical sprue and pellagra are everywhere to be seen among the poorer people. In short, practically all the signs of malnutrition, with the exception of widespread dental failure, can be observed in the island. For some reason still not understood by nutritional science, the children and even adults of Puerto Rico, who hardly drink any milk, and do not eat cheese or other rich sources of calcium, possess admirable teeth, the envy of well fed visitors from the mainland.

Good teeth, exhibited in broad, Latin American smiles, are the only sign of health left to the primitive Puerto Rican population, to whom civilization has been brought through the good offices of the United States. On all other counts, the population has been reduced to inferiority. It is not extreme, indeed, to compare the island of Puerto Rico, so far as the living condition of its people are concerned, to the island of Hong Kong in the China seas. The English established themselves on Hong Kong by the Treaty of Nanking, in 1842, but until today they have done nothing to improve the living conditions of the Chinese who subsist there, bound in mire and misery like the natives of this other "island slum", as Vogt called the territory of Puerto Rico.

In spite of the post-war measures aimed at increasing industrialization and promoting diversification of agriculture, Puerto Rico remains a kind of Hong Kong of the Americas.

8

No doubt it will come as something of a shock, particularly to American readers, to find part of the United States included among the great hunger areas of the world. And it does seem paradoxical that hunger should exist in a land of abundance like the United States, where agriculture has always had to contend with surpluses, and where productive capacity during the last war was sufficient to help feed half the world.

But the existence of hunger right in the world's supply house is an undeniable fact. It is not a matter of a small plot, but of a geographical region large enough to include whole countries. This hunger area in the United States is the South, a region with about 500,000 square miles of surface and a population of some 30,000,000 people.

In the colonial period, the South was represented by the five English colonies of Maryland, Virginia, the Carolinas, and Georgia. Today it is a hard task for the geographer to set precise limits to the region, but for the purposes of this study I will consider the South, somewhat mechanically, to be the area corresponding to the old agrarian, slave-holding South, including the following eleven states: Virginia, North Carolina, South Carolina, Kentucky, Tennessee, Georgia, Florida, Alabama, Mississippi, Louisiana, and Arkansas.

There is no doubt but that the Old South has always been a hunger zone. Its habitual condition is demonstrated by certain figures published by the National Research Council, which examined nutritional conditions throughout the country during the last war.

In a bulletin issued in 1943, the Special Committee set up to study this question reported that in the South only 27 per cent of the population made use of an adequate diet. That is to say, more than two-thirds—73 per cent—of the inhabitants of the South received an improper diet, and consequently suffered from one kind of hunger or another.

Such a situation is shocking not only to the layman but to those who have a detailed knowledge of the geographical background of the region. A study of the roots or causes of starvation in the southern United States reveals another typical example of hunger as a man-made plague, since the region is eminently suited by nature to the production of adequate food supplies. Few regions of the world have such a high potential agricultural yield, such abundant natural resources lying ready to the hand of man. Few regions of the world have been so ruthlessly sacked and plundered, so wasted by ill-conceived use and by permanent maladjustment of man to his environment.

Howard W. Odum, who is considered one of the greatest living authorities on the geographical and social problems of the South, has made an admirable summary of the impressive natural wealth of the region, which he pictures as a veritable kingdom of abundance:

> "This superabundance of well-nigh limitless sources of natural wealth is measured also by great range and variety: rainfall and rivers; climate and growing seasons; land and forests; minerals from the land undug; sticks and stones of fabulous quality and quantity for the fabrication of great buildings and for the construction of roads and bridges; energy and power, and tidal power; iodine and phosphorus and nitrogen wealth; chemical resources from pine and vegetable, cotton and corn; parks and playgrounds, mountain and seashore, summer and winter resorts, play places of a nation; nature reserves and sanctuaries for wild life; flora extraordinary, grasses and cultivated plants to feed man and animal and land; fauna of the woods and fields, millions of game, for commerce and recreation; domesticated animals on farm and grazing lands, race horses and work mules, makers of a culture; and many other tangibles and intangibles of geography's situation, relief, and area.
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> "If the enumeration of the superabundance of natural resources begins with oceans and rivers and rainfall, and if to abundant waters be added long, frostless growing seasons and soil of variety and richness, there will be projected boldly the basic vein of natural resources stretching across and throughout this southeastern region of eleven states not one of which is outside the range of superior advantage. In the measure of its rainfall, the

> whole of the south-east lies within the bounds of that magic area which measures more than 40 inches average annual precipitation. Of the 27 per cent of the nation's area in which a frostless growing season of six months or more is available, the south-east itself has nearly a third, while the south-east and the south-west together aggregate more than two-thirds of the total."

Two fundamental traits which Odum has mentioned warrant, for the purposes of our study, a more detailed analysis: the soil of the region, and the climate, both of which are well suited to agriculture. The greater part of the land is yellow and red Podzoil. This may not be so fertile as the black soil, or chernozen, of the northern and central United States, but it is far superior to the tropical soils that cover most of the other regions of the hemisphere that we have studied so far. And in addition to the podzol in the South, there are great stretches of still more fertile soil, such as the black lands of Alabama—the black belt—so called not because some 87 per cent of its population is Negro, but on account of the dark coloration of a soil rich in organic matter. Strips of rich alluvial soil cut across the South in various directions—the James River valley in Virginia, the cradle of southern culture; and the Mississippi valley, which extends, 80 miles wide on the average, for a distance of 500 miles from the mouth of the Ohio to the delta. This alluvial strip, according to Emory Hawk and other authors, has proved "as fertile as the famous Nile Valley". Although the climate of the South shows considerable local variation, it is on the whole very favourable to agriculture. It has an abundance of rain and sun, and well defined seasons, with mild winters little subject to snow or freezing.

These natural advantages were of no avail to keep starvation away in the face of colonial economic policy. In the economic history of the South may be found the whole explanation of its tragedy, of "the dramatic struggle of a large and powerful segment of the American people for mastery over an environment capable of producing a superior civilization." Odum said the present "landscape of dilemmas", as he has called it, with hunger as one of its outstanding features, is a cultural heritage of the pioneering epoch, of colonial conditions and of slavery. It has been further impoverished in modern times by the activities of land speculators.

The first settlers of the southern colonies attempted to set up on the soil of Virginia a diversified agriculture based on the same plants they were accustomed to grow in England. Opening clearings in the forests around Jamestown, they sowed wheat, and fruits and vegetables which they had brought from the Old World. The fruit trees developed well, but the wheat was another story. "They soon discovered," Hawk relates, that, ". . . while the plant shot up to an amazing height in the extraordinary soil, the kernels unfortunately would not harden into grain." So the colonists gave up the idea of growing wheat; and, learning from the Indians, they undertook to grow native plants such as corn, beans, sweet potato, squash, melon and strawberries. Some European products were gradually introduced, and the colonies began to develop toward a subsistence culture which promised to become self-sufficient.

Unfortunately, this line of development was not looked on with favour in the England of that day, whose colonial system was based on mercantilism. Colonies were considered simply as sources of raw materials not produced in the mother country, and as new markets for manufactured products. The London Company, which had obtained the rights to exploit the South from James I in 1606, considered that the most urgent problem for the economic success of the enterprise was to discover an exportable product that could be produced on a large scale. It should not be forgotten that the Company was made up of "knights, gentlemen, merchants and other adventurers", from London and other places, all of them interested in one objective—large profits, and quick, from their colonial investment.

The first staple export crop that the directors of the company attempted to produce was silk. The attempt failed. Grapes were then tried, and this crop too failed to come up to expectations. The company was on the verge of bankruptcy when the profitable export commodity was finally discovered—a native agricultural product, tobacco. A system of great plantations rapidly sprang up, and the culture of tobacco soon spread to the greater part of the cultivable land of Virginia, Maryland, and the Carolinas. Further west, particularly in the Mississippi valley, cotton established itself, first on an experimental basis and later as absolute king, while sugar cane later took possession of the coastal areas of Louisiana.

Thus three products—cotton, tobacco, and sugar—with cotton in the lead, took over the South, and enslaved both man and soil to the caprices of speculative fortunes. The cultivation of these commercial products transformed the regional economy completely. Land tenure, which began as a system of small holdings, soon reached extremes of concentration. The size of the average farm was as much as 160 acres in 1626, and had risen to 446 acres in 1650 and to 670 acres by 1700. At the beginning of the eighteenth century the government, in an attempt to limit the concentration of landholding, limited land patents to 4,000 acres, But the great landlords were by then absolute sovereigns of their domains, making and breaking laws at will, and they chose to ignore the federal legislation.

The great plantations continued to grow, so that by the middle of the eighteenth century there were southern aristocrats with properties of 150,000 acres. In order to work these huge tracts of land, Negro slaves were introduced into the southern colonies in 1619, and from that moment the typical system of monoculture began to develop, with all its train of melancholy consequences; insufficient food, wearing out and erosion of the soil, slavery or forced labour, periodical economic crises, and a low biological and cultural level of the population.

The process by which the plantation system brought starvation to the regional population was the same, in general outline, as that in other one-crop areas already studied. Food shortages appeared at once, the logical result of the fact that slave labour was directed exclusively toward the planting of crops for export, while subsistence culture was reduced to a minimum. The consequence was the most inadequate kind of diet, a hunger diet that killed off the Negroes in a short time. But under this economic system it was cheaper to replace the dead slaves than it was to permit them a normal life span, with proper nutrition and fewer hours of work.

Since the war of secession and the emancipation of the slaves, southern agriculture has relied on the labour of tenants and share-croppers, who make up the bulk of the rural population. As an indication of the predominance of such workers in the labour system of the region, Odum points out that of the 2 million families living in the cotton belt more than half own no land. They live as tenants, at the mercy of the price fluctuations of their speculative commodity. And in certain sub-areas, the number of tenants approaches the total number of inhabitants: in the Black Belt, 73 per cent; in the Red River bottoms, 80 per cent; and in the Delta region, 90 per cent.

The share-cropping system, which is a hangover of European feudalism and of the slave system of colonial times, has permitted the survival of a kind of semi-slavery, which limits the freedom of the labourer, forcing him to do a certain kind of work and to accept only a part of the product in payment. The percentage is calculated in such a way that it ordinarily fails to provide enough to eat. The majority of American sociologists who have given thorough study to this system consider it one of the "public scandals of America". Gunnar Myrdal, the great Swedish sociologist, sees in the system one of the most tenacious links in that vicious circle of misery—monoculture, tenancy, soil exhaustion, and erosion. This system brings with it "poverty for most, economic insecurity for all, widespread ignorance, low health standards, relative lack of an enterprising spirit, high birth rates and large families". In these words we can read the step by step development of this area, beginning with the improper ownership and exploitation of the land, bringing human beings to inevitable poverty, hunger, and overpopulation.

Even where the plantation system fell into decadence, through parcelling out the land in certain places after the Civil War, living conditions have remained precarious, because wages in the South are kept down to the lowest levels in the country. King Cotton imposes these levels in order to compete in world markets with the produce of other countries where living standards are low. And substandard wages are endured because the rural population has no other work to turn to.

On the one hand, the raising of cash crops for export degrades human labour; on the other hand, it exhausts the soil. Cotton and tobacco were planted in the early period without any fertilizer and without crop rotation, and this soon led to the depletion of the best regional soils. These soils were so thoroughly stripped of their humus and mineral salts that huge and continuous quantities of fertilizers are now necessary in order to keep them in production. This constitutes a heavy burden on southern agriculture.

Thanks to the exhausting monoculture practised in the South, the greatest stripping of topsoil ever seen anywhere in the world has taken place there, and enormous areas have been rendered sterile by erosion. In a study carried out in 1933 by specialists in the subject, it was demonstrated that a third of all the land in the South is eroded; and that at least half of all the eroded land in the United States is found in the South. The figures which told of hundreds of millions of acres become useless, particularly on the slopes of the Piedmont—great gullies showing red at the bottom like bloody gashes in the body of the earth—produced a state of national alarm. And the result was a rash of narrow theories which attributed all the misery and hunger of the South exclusively to soil erosion.

In truth, the alarmists had the effect of producing a certain confusion in the interpretation of the facts. Erosion is not the cause of the decadence and hunger in the South. All of these things, erosion and hunger and misery, are effects of a single cause: improper economic development of the region. Soil erosion, and the erosion of the human potential, are the disastrous results of a single factor: the plantation system. The eminent American expert, Charles Kellogg, was quite right in saying that "soil erosion is an important symptom of bad relationships between people and soil, just as a headache is often a symptom of some more fundamental illness. Civilizations can hardly be said to have declined from soil exhaustion—soil exhaustion is more a result of the decay of the people, of the civilization." Caught in this net of negative factors—inadequate production, wornout soils, and low salaries—the human beings of the region necessarily suffer from improper diet, a diet both insufficient and incomplete.

It is a well-known fact that the bulk of the people "live on the three M's: meat, meal, and molasses". The meat is salt pork, practically all fat; the meal is corn meal; and molasses is cane syrup. To these basic foods, rice, beans, or sweet potatoes may be added in certain areas. But they do little to improve the diet, which is tremendously defective on the face of it, lacking protective elements such as meat, milk, eggs and fresh vegetables.

In a notable study of the relationship between economic factors and nutritional conditions in the South, Goldberger and Sydenstricker show how the lack of protective foods is a result of the one-crop system, and of nothing else. These scientists point out that there have never been enough milk and meat in the South because the great landowners always discouraged cattle raising. Pastures would divert land from their cotton fields, and tenants would give the cattle hay that was needed for the mules and horses used in growing cotton and sugar cane. In the same way, the big planters never encouraged the planting of gardens and orchards. They would take up space, and would absorb labour that could not be spared, even for a moment, from the fields devoted to cash crops. And although from 60 to 70 per cent of the tenants keep chickens, they are generally few in number, and eggs come into the diet only occasionally.

The restrictions imposed on slaves, and later on tenants, against using the land for raising fruits and vegetables, have broken not only the will of the people to raise such foods, but also the habit of using them. The result is that today, when the South is tending to diversify its agriculture and produces appreciable quantities of fruits and vegetables, the farm families, through force of habit, still stick to their dangerous and monotonous diet of corn, sowbelly, and molasses.

It is clear that the continued use of such a diet must have serious physical consequences. And indeed ever since colonial times, both Negroes and "poor whites" have exhibited a series of complaints that were surely due to faulty nutrition, although they have been attributed to such causes as bad climate, poor working conditions, or even to some sort of racial atavism.

Of the deficiency diseases common to the zone, one stands out for its alarming frequency: pellagra. Although Babcock believes that it has been widespread in the southern states since 1828, medical men began to call attention to the disease only at the beginning of our own century. They pointed out also that it seemed to be increasing at a shocking rate throughout the area. The presence of pellagra in all the southern states was recognized in 1909, and in a few years the number of cases of the terrible illness reached a hundred thousand, with an annual death toll of some 4,000 persons.

As we have seen, pellagra represents a complex of dietary deficiencies, centred in a lack of nicotinic acid. It is the characteristic disease of poverty and misery, and its increase in a region always reveals an intensification of distress and wretchedness. There are some who would explain the increase in the number of pellagra cases in the South, between the end of the past century and the beginning of the last war, simply by the greater skill of doctors in diagnosing the disease. Others, however, see the phenomenon as a reflex of the economic evolution that has taken place during these years. And the latter would appear to be right.

Pellagra takes such a toll in the South that in certain localities it affects 25 per cent of the rural population. In Tennessee, Arkansas and Mississippi, Goldberger calculated the incidence in 1927 at between 10,000 and 20,000. And as late as 1938, Sydenstricker and Sebrell arrived at independent estimates of 100,000 as the number of cases of pellagra in the United States at that time, with mortality, in 1940, reaching 2,123 cases.

An analysis of the incidence of pellagra by years reveals a close correlation with the movements of the cotton market. The number of cases increases in years of economic depression, diminishes following periods of prosperity. Thus, in 1916, following the 1914–15 depression in the cotton exchange, pellagra reached alarming proportions, even becoming in South Carolina the second most frequent cause of death. There was another epidemic of pellagra in 1927, following the low cotton prices of the previous year and the great Mississippi flood which destroyed a good many plantations in Tennessee, Arkansas, Mississippi, and Louisiana. After the 1929 crash, the line of pellagra incidence rises again. And even today, in spite of improvements in dietary conditions accomplished during and after the last war, pellagra continues rampant, although on a more limited scale, in both its typical and milder forms.

By the side of pellagra, many other vitamin and mineral deficiencies have been registered in the area. Anaemias due to iron deficiency, generally aggravated by worms, are extremely common, especially among children. Vitamin A deficiencies have been noted in proportions that reach 50 per cent of the rural population of Tennessee.

Vitamin B_1 deficiencies, which formerly took a heavy toll in Louisiana in the form of beriberi, still continue, particularly in partial form. The absence of other elements of the vitamin B complex is troublesome locally; riboflavin deficiency, according to Spies, Beans, and others, is the commonest of all the dietary deficiencies of the South. Food conditions are so bad in some areas that along with specific deficiencies one finds quantitative hunger or semi-starvation as the result of insufficient calories. A study made in Tennessee by Youmans and others demonstrated that all sections of the population, except children from one to six, received less than the recommended number of calories daily. In certain groups, the deficiency represented 45 per cent of the total energy required.

It is no wonder that under such conditions of quantitative and qualitative starvation, many individuals are, through lack of energy and initiative, incapable of working.

Although small land holdings have increased in the South since 1900, so that latifundia are now less common there than in other parts of the United States, the same period has seen an increase in the number of absentee owners. Although 64 per cent of southern farms were operated by their owners in 1880, this figure fell to 53 per cent in 1900, and to 44 per cent in 1930. This increase of absentee ownership represents the purchase of rundown southern farms by bankers and financial groups of the North.

These same financial groups also turned towards the industrial exploitation of the South. But this industrialization—which has expanded greatly in the last three decades—became, in certain cases, a cause of pauperism rather than enrichment of the local populations. The reason was that many northern factories moved south in search of cheap labour and succeeded in maintaining wages at extremely low levels.

Absentee ownership has greatly aggravated the economic plight of the South. With absentee capital in the saddle, living conditions in the area became worse than ever, and the nutritional situation during this period has been worse than that of the slaves in colonial times. It was perhaps this new form of colonization of the South by great insurance and banking houses that led to a large-scale migration of the southern rural population to other parts of the country.

The economic disorganization caused by capitalist land exploitation, mechanized farming and cheap labour industries resulted in the expulsion of large numbers of tenants and sharecroppers. Many of these set out for the West, forming the strangest and most paradoxical caravan of all time. The poor victims, ragged and starving, travelled mainly in automobiles—the symbol of prosperity in our mechanistic civilization. It is true of course that the cars used by the swarms of migrants were old and secondhand, pieces of junk that burned up their worn-out motors and fell apart along the way—swelling the junk cemeteries by the side of the road in competition with their owners, who also populated western cemeteries with their old and worn-out remains. As John Steinbeck portrays them in his *Grapes of Wrath*, these paradoxical car owners without a nickel to buy bread for their starving children, are a perfect symbol of misery in the midst of plenty, a characteristic condition of the Old South.

It should be emphasized that in recent years this black picture of hunger has been clearing up somewhat, thanks to measures put into effect by various governmental agencies. The impact of the war, requiring the rationalization of the production and distribution of food supplies, had a very beneficial effect on dietary conditions in the South. In a report entitled "Our Food Front" issued in November, 1943, Dr. Russell Wilder commented on the improvement that resulted from the war, and observed that "there is reason to believe we have less hunger in America than we had before the war".

Federal projects such as the Tennessee Valley Authority, which benefited four and a half million people in seven states through rational control of land, water, and all the various resources of the region, necessarily brought with them a relative improvement in local living conditions. Within ten years, for instance, the T.V.A. effected an increase in the regional individual income of about 75 per cent, as compared with an increase in national income, for the same period, of 56 per cent. This rise in the economic standard is naturally reflected in all aspects of life in the region, including diet.

Nevertheless, nutritional conditions in the South leave a great deal to be desired. As an American nutritionist, Grace A. Goldsmith, has written: "While the incidence of severe deficiency disease, such as pellagra and beriberi, has decreased markedly in the past decade, mild deficiency syndromes are still common and the dietary habits of a significant proportion of the population are far from ideal."

For a long time still the dilemma of hunger in the South will challenge the best efforts of the economic planners and technicians of the United States, and the dark blotches of hunger will continue to mark the "rural slums of the South", which in the opinion of John Gunther, "are almost beyond doubt the most revolting in the nation".

CHAPTER IV

HUNGER IN ANCIENT ASIA

ASIA, MORE THAN any other continent, is the land of man, and the land of hunger. Nowhere else has man carved the evidences of his presence so deeply into the earth, and nowhere else has hunger left such profound marks on the structure of human society. The oldest human fossil, that of *Sinanthropus Pekinensis*, was found in Asia, and from Asia came the tales of the first famines to ravage the human species.

It was, then, in Asia, whose name means "Land of the Rising Sun", that man first arose, and along with man, hunger. Every day that the sun rises above the waters of the Great Ocean, and lights the Asian countryside with all its contrasts, it throws into violent relief the visible evidences of man's age-old struggle against starvation. For Asia is the most humanized of the continents; men have lived there longest, and, in our time, in the greatest concentration. When one examines the religious doctrines, the moral codes, the community customs and the living habits of its people, one sees that throughout the centuries the most decisive influence on all these cultural manifestations has been the state of nutritional poverty to which these human groups have been subject. No other social factor anywhere has moulded human conduct with such despotic control as has collective hunger in the Far East.

Three-quarters of all these peoples' activities are devoted to grubbing in the reluctant soil for their slender subsistence. Consequently, all their impulses, thoughts, gestures and actions are forever directed toward that vital objective. This is life in ancient Asia, that mysterious cradle of the human race, where more human beings have been born and have died than in any other region on our planet.

Asia makes up only a third of the land surface of the globe, but in it are concentrated two-thirds of the world's population. The continent thus has a demographic density of 72 inhabitants per square mile, as compared with 26 for the rest of the world. It is undoubtedly this enormous reserve of humanity, this compact human coating, more dense and varied than in any other part of the world, that gives the continent its peculiar geographical personality. Beneath the feet of those pullulating Oriental multitudes there stretches a landscape which is enormously varied in form and characteristics. The immense continental mass may be divided into a least five great natural regions: the Far East, including China and Japan; south-east Asia, consisting of the peninsula of Indo-China; the sub-continent of India; the Near East; and, finally, the immense expanse of continent in the extreme north, which makes up part of the Soviet Union. In this chapter the first four regions of Asia will be treated as a unit, leaving aside the Soviet Union. The Soviet Union connot be considered as entirely Asiatic, just as it is not entirely European. It is, in fact, a sort of bridge between the two continents and the two cultures. As the Iberian peninsula has always been a bridge between Europe and Africa, Russia, even before the advent of Soviet socialism, has served as a transition zone between the cultures of Europe and of Asia.

I

Agriculture has been practised on Chinese soil for more than forty centuries, since the first farmers took root around the banks of the Yellow River. These were the people who expanded their dominions and spread their culture, customs and traditions over the enormous area that makes up Greater China, the second largest country in the world, exceeded in area only by the Soviet Union. China's typically agrarian civilization covers an area of 3,500,000 square miles. At least 400 million of the 500 million individuals who inhabit this giant among nations live in intimate contact with the soil or with rural activities.

China has the densest concentration of rural population in the world, and the character of Chinese life is predominantly rural. Where 23 per cent of the residents of the United States live on farms, the proportion in China is upwards of 80 per cent. In spite of such devoted and all-absorbing agricultural activity, or, indeed, as a result of it, China has always lived in a shocking state of nutritional poverty and her people, more than any other in the world, have suffered the painful consequences of hunger. Nowhere has hunger been such an overwhelming problem as it has in this civilization based almost exclusively on subsistence agriculture. Alimentation is so urgent a question that colloquial peasant speech employs more metaphors referring to food than to any other aspect of life. Walter Mallory points out that the polite salutation between friends is, "Have you eaten?"

Although the country is essentially agricultural, farming goes on, practically speaking, only in the third of the country that lies nearest the coast. Two-thirds of China, including the central area, is almost entirely desert or mountain territory, unadapted to agriculture. This situation is reflected in the distribution of the population, which is closely concentrated in the more easterly part of the country. If the map of China is divided by a north-and-south line running through the centre of Yunan province, the population of the western part, which takes in 2 million square miles, is 17 million, while 450 million people are jammed into the million and a half square miles of the eastern section. The population of China piles up in regions where the soil can furnish at least a minimum subsistence—in the great river valleys, particularly in the alluvial deposits of the deltas, and on the broad northern plains where the winds, plundering the great central deserts of Asia, have deposited a fertile layer of loess.

The uneven distribution of human beings shows how strictly the Chinese is dependent on the soil and climate of his country. Yet these are far from the optimum for farming. John Lossing Buck, whose study of rural life in China is the most objective that has been made, says that the agriculture of no other country faces so many natural obstacles, especially climatic hazards. The exceptional heroism of the Chinese farmer's struggle against fickle nature has been well described in F. H. King's *Farmers of Forty Centuries*.

The first difficulty of Chinese agriculture is the relative scarcity of tillable soil; great areas, as the geographer Cressey points out, are too cold or too dry, too mountainous or too sterile, to make farming worth while. Thus in spite of the pressure of an extremely dense population, only a small part—10 to 15 per cent—of the national soil is cultivated. According to the estimate of Dr.

Gerald Winfield, China has only 217 million acres of land under cultivation to provide for 500 million inhabitants, whereas the United States tills 365 million acres for a population less than a third as large. China's disproportion between population and cultivated land has two results: regional overpopulation, and an extreme subdivision of the land, far beyond the limits of reasonable economic exploitation.

The concentration of humanity on the land reaches absurd extremes in the alluvial plains of the great rivers. On the Yangtze delta near Shanghai and on the delta of the West River at Canton, density rises to the imposing figure of 4,000 individuals per square mile. In these superpopulated zones the subdivision of the land is carried so far that Cressey, forcing the metaphor a bit, speaks of "microscopic" plots. Seen from an airplane, these areas actually do suggest a cross section of tissue under the microscope, with its thousands of cells of various sizes and types, alike and yet slightly different, crowded against each other. Each cell is a farm, and a whole family depends on it for subsistence.

The veritable mincing of the soil of China creates the problem of *microfundia*, a threat as serious to the agricultural potential of the region as the opposite extreme—*latifundia*—is to Africa and Latin America. The average size of a Chinese farm is 4·18 acres, compared to 14 in Holland, 39 in Denmark, 63 in England and 157 in the United States. This is the average size; there are a great many properties much smaller. According to Buck's researches in several parts of China, some 23 per cent of the farms were only half an acre, and there, without other income, lived an average of 4·4 persons! The Chinese peasant, isolated and without commercial exchange, absolutely dependent on local food resources, preserves an economy very similar to that of feudal times.

China's economic organization forces the farmer to root himself to the ground as tightly as a tree, and to set up such an intimate relationship with his environment that China functions, in the felicitous phrase of Gerald Winfield, like a balanced aquarium, where plants and animals are mutually and indissolubly adjusted to each other in order to maintain the cycle of life. Just as in such an aquarium, everything in Chinese agrarian economy is fixed in its relationships and governed by hard and fast rules, so as to avoid the imbalance that would spell disaster for the human groups concerned. This precarious ecological equilibrium, which is continually threatened by adverse natural conditions, has forced the Chinese farmer to utilize only the most favourable soil, and to concentrate on the cultivation only of those plants that give a high yield in his particular locality. The result is a limitation of the cultivated area as well as a limitation of the number of crops grown on any appreciable scale.

Buck, trying to describe the agricultural organization of China in detail, has divided the country into eight zones, but in terms of food production many of these zones are practically alike. There are significant differences only between two great areas, the north and the south. The natural and cultural features of these regions are so different that in the thirteenth century Marco Polo, who was one of the first westerners to explore the East, described two separate Chinas: the north, which he called *Cathay*, and the southern kingdom of *Manji*.

The warm and humid south, with its heavy rains and its mountainous soil traversed by fertile valleys, is the great rice bowl of China. Above the Yangtze River and the Tsinling Shan lie the broad and semi-arid plains of the north. Here there is hardly any rice; it is the land of wheat, millet, sorghum or *kaoliang*—the land of the soy bean.

Agriculture in both of these great areas is intensive; in the wheat country as in the rice country the farmer strains his hardest for the largest possible yield. It is surprising to find that the Chinese, ignorant of scientific agriculture, working with his antiquated methods a soil that has been cropped for more than four thousand years, is usually able to take out a harvest that, acre for acre, is larger than those achieved in the United States. Dr. Winfield points out that average rice production in the United States is 47 bushels to the acre while in south China it is 67, and that the wheat production figure of 14 for the United States is exceeded by north China's 16. To get this yield, the Chinese peasant devotes himself body and soul to the cultivation of the soil, paying the land back in full for all it gives him. This intimate mutual dependency of man and the good earth has created the Oriental philosophy of life, and it underlies the mystical conception of an unbreakable bond between the everlasting land and the everlasting blood—the union of the soil with the soul of the race.

So that their meagre earth will let the Chinese people go on living, the maximum number of arms are set to tame it, and the maximum number of hands nurse the plants that grow in it. The typical plant of Oriental culture—rice—is so petted and caressed throughout the year by Oriental hands, planting it, transplanting it, weeding it, irrigating it, that one geographer has remarked that Chinese rice grows half the time in the soil and the other half in the palm of the farmer's hand. The excess of loving care which the Chinese lavishes upon his rice has made the plant, like a spoiled child, exacting in its demands for attention. As a natural consequence of so much hand labour, the production, although relatively high per acre, is extremely low per capita. According to Winfield, a Chinese farmer harvests only 3,000 pounds of grain from a whole year's work, while the American farmer produces 44,000 pounds, fourteen times as much.

2

Asia has been called the land of contrasts, and these contrasts are even more violent in the human than in the geographical sense. The distance that separates a pariah of the lowest caste—untouchable, dispossessed of all human and property rights—from a maharajah in his indescribable wealth and power, is far greater than that between the Himalayan peaks and the deepest point in the Pacific Ocean. There is an equally striking difference between the menu of a high Chinese dignitary's feast-day banquet and the daily diet of a simple peasant.

Illustrious travellers have described Oriental banquets, with interminable courses of esoteric dishes; surveys made in rural China paint a picture of millions upon millions of people who, throughout their whole lives, day after day, year after year, eat one food, morning, noon and night—rice. Platt tells us that in the South a new-born baby begins to be fed a thin paste of slightly sweetened rice flour on his second day, and that the adult depends on rice for 80 to 95 per cent of his energy ration. In the north, the farmer bases his diet on wheat bread and sorghum. In both sections, the diet has three fundamental characteristics: it is almost exclusively vegetable in origin, it is scanty in quantity, and it is extremely monotonous. The Chinese does not limit himself to this sober menu because he enjoys it. On the contrary, it represents a kind of sacrifice for him, since on feast days he changes his habits and stuffs himself with a variety of food, animal as well as vegetable. This happens on the great occasions, once or twice a year. The habitual vegetarian diet, meagre and monotonous, is a necessary evil for those who must practise the strictest economy in order to have food to eat the year around.

Vegetable foods are so predominant in the diet that only 2 or 3 per cent of the total calories are of animal origin, compared to 39 per cent in the United States. The Chinese cannot afford to waste his limited soil in the raising of animals, and he knows it; animals yield much less nutritional energy per acre than do plants. The Chinese knows that a vegetable eaten directly by man furnishes infinitely more energy than the same product indirectly utilized in raising livestock. Unfortunately, the task of obtaining enough energy for his basic, vital functions has always been the immediate and burning problem with him. By giving himself almost entirely to agriculture, and planting only high-energy foods such as rice, wheat and millet, the Chinese farmer still falls short of a ration of 2,250 calories daily. Where would he be if he indulged in the luxury of converting vegetable calories into animal calories? In this conversion, the scientists have found, a very small part of the energy consumed by the animal is recovered. Fifteen per cent is recovered in producing milk, 7 per cent in eggs and only 4 per cent in beef. This is the biological determinism which keeps the Chinese from raising animals to eat. In the United States 90 per cent of the domestic animals are raised for food; in China, only 25 per cent. Most of them serve merely to assist man in growing plants.

The only domestic animal of real importance to the Chinese dietary economy is the pig, because the pig fits better than any other into the restricted relationships of the balanced aquarium. First, the pig recovers more energy from his food than other animals, averaging a recovery of 20 per cent of the energy expended in feeding him. Second, a pig in the Far East is a sort of scavenger whose job is to make use of all the scraps and leftovers of the household. As Winfield puts it: "In a balanced aquarium there must be some snails—scavengers to eat up and break down waste and to prevent the collection of debris. The pig is the snail in the China aquarium."

By tossing the household leftovers into the "pig latrine" against the side of the house, the Chinese obtains an extra quantum of energy from materials otherwise of no further use to man. Winfield writes what he calls the biography of the Chinese pig, showing its various functions as an important link in the nutritional life-and-death cycle. As evidence of the lengths to which the Chinese go in economizing food energy, it is interesting to note that the pig is never driven to market on foot, as is done in certain parts of the west; it is carried, by one or two peasants, so as not to walk off any weight on the way. The energy expended by two men who walk for miles with a live hog strung to a pole across their skinny shoulders seems less important than the energy embodied in the pig, even though it is a product of human waste.

In certain areas of the west where agricultural production exceeds local consumption, as is the case in the American corn belt, the excess grain is used to fatten hogs, this being the most economical way to market the corn—sacked, that is, in pigskin. In China, on the other hand, there is never any question of excess, and the pig's hide holds only what could not be used in any other way. Then too, the pig contributes to the delicate balance of the China aquarium by producing a regular supply of manure, which is mixed with the human product and saved to fertilize the fields.

The scantiness and the monotony of the Chinese diet exist because of an economic structure that can only result in a production both insufficient in quantity and limited in variety. This insufficient and incomplete diet gives rise to chronic starvation in various forms. The Chinese suffer, first of all, from quantitative hunger—the lack of enough energy to cover the needs of living and working. Almost everyone in this part of the world is skinny, because there is no margin, no surplus in the nation that might be used to accumulate a reserve of fat. The rhythm and the yield of labour in China among the slowest and lowest in the world, reflect in part this lac of the fuel required for muscular labour.

Far more serious than this quantitative hunger are the qualitativ hungers, the specific hungers to which these people are permanentl subjected: hungers for proteins, mineral salts and vitamins. Protei hunger is practically universal, since the sources of complete proteins meat, eggs and milk, are almost entirely absent from the diet. Th pig is the only domestic meat animal in China, and the consumptio of pork, in proportion to the population, is quite insignificant Pork products are used more as appetizers or as seasoning than a basic food elements. They merely serve to improve the flavour an aroma of rice or of soy bean soup.

Religious prescriptions, both Buddhist and Brahmanist, hel keep down the consumption of animal protein. The Buddhis belief in metempsychosis, the transmigration of souls, forbids th slaughter of animals for fear of killing a relative or an ancesto reincarnated in the animal. Fortunately, these prohibitions, i the majority of sects, do not apply to fish. Fish may be eaten i some areas because, not having warm blood, they are not amon the true animals of transmigration; in other areas it is felt that fis may be eaten without killing them, since if they are caught an removed from the water, they die tranquilly by themselves. Thes religious prohibitions, of course, simply work a magical sublimatio of a hard economic and geographic reality: the scarcity of meat i the region. As the population outgrew the supply of anima products, the religious code sought to relax the tension by settin limits to the consumption of meat—a good example of the hidde connections between the economic and religious life of a people.

Protein deficiency is more serious in the south, among the ric eaters, than it is among the wheat eaters of the north. Wheat i richer in protein than rice, and the soy beans of the north suppl proteins of high biological value. Protein hunger shows itself i various ways. The primary sign of its presence is the retarded growt and reduced stature of the average Chinese. The majority ar short people, and the more deficient their diet in protein, th shorter they are. The average height of the Chinese people increase from south to north as the protein in the diet increases.

Another serious result of protein deficiency is the appearance o liver lesions, which are the basis of the hepatic cirrhosis so commo in the Far East. It has only recently been discovered that thes liver conditions are due to a deficiency of certain indispensabl amino acids which are constituents of proteins. According to a commission set up by the Food and Agriculture Organization to stud nutritional conditions in the Far East, this is "the most common o all food deficiency states in the tropics and in the East".

The effects of protein deficiency on the general health, in the broadest sense, are shown in a definite lessening of the body's resistance to infection. This lowered resistance has its disastrous reflection in health indices and vital statistics. Protein hunger has a significant effect on the conduct of human groups; in the *Chinese Year Book* some Chinese authorities consider this grave nutritional deficiency to be one of the basic reasons for the "lethargy, inefficiency indecision and lack of stamina" of their own people.

A second serious and widespread specific hunger among the Chinese is that caused by a deficiency of calcium in the diet. It has been experimentally demonstrated, as the physiologist, Maynard, emphasizes, that it is rather difficult to supply the calcium needs of a population without using dairy products. Yet milk is almost never used in China, even in infant feeding. The alternative, though less efficient, source of calcium is the leafy vegetables, but these hardly enter into the Chinese diet. Thus there is no compensation for the calcium deficit, and no way of avoiding its usual results: tooth decay, rickets and softening of the bones.

Rickets attacks the children in zones where there is little sunshine, and consequently little vitamin D. Softening of the bones is common among women, particularly after repeated pregnancies when their bones have been robbed of calcium to build up the babies' bony structures and to supply them with milk. In Shansi province, where there is a vicious custom of feeding mothers nothing but rice gruel for a month after delivery, a shocking number of women are crippled by softening of the bones; while in parts of Tibet where pregnant women are customarily given pork ribs cooked in vinegar sauce (which attacks the bone and dissolves out the calcium), the disease is a rarity.

Iron deficiency is another specific hunger with grave results for the Chinese people, some of the most anaemic in the world. Their nutritional anaemia is greatly aggravated by worm infestation, particularly by the hookworm disease which is so extraordinarily widespread in China. The worms responsible for this disease, operating in the intestine, rob the body of an appreciable amount of blood, as much as half a pint a day in cases of severe infestation. Since the body has neither proteins nor iron available for the manufacture of blood corpuscles to replace this loss, the result is anaemia, very often fatal anaemia.

Parasites are an aggravating factor in mineral deficiencies; on the other hand, the high incidence of worms and such other intestinal parasites as the agents of amoebic and bacillary dysentery is mainly the result, although indirect, of nutritional poverty. It is indeed a vicious circle, as Dr. Winfield has pointed out in the profound study of these filth, or faecal-borne, diseases which he made during his long stay at Tsinan's Cheeloo University. The prevalence of these diseases, which affect 90 per cent of the rural inhabitants of China has several causes, but the principal one is the use of human wastes as fertilizer. Completely lacking chemical fertilizers, and lacking sufficient quantities of animal manure, the Chinese use the only means available to restore nitrogen to the soil; human wastes are recovered in both city and country and returned to nourish a soil weary with forty centuries of fruitfulness. The forced use of human excreta is one of the most tragic examples of the circulation of matter in this land of starvation. Everything that comes from the soil must be returned, so that the soil and the human life and civilization based on it will not perish. Everything belongs to the soil, and man lives on loans, made out of the supposed generosity of that earth which religion orders him to venerate as the land of his ancestors. If men's food comes entirely from the soil, then they must return all their waste to the soil, and when they die be buried there, making restitution to the last particle of the organic matter they have borrowed. If for hygienic reasons the Chinese ended their unwholesome practice of using human faeces for fertilizer, the production of their fields would decline and the periods between the famines that they dread grow shorter. Yet, as a result of fertilizing the fields with human waste, several million people die every year—perhaps about the same number that would die of hunger if the fields were not so fertilized! Everything comes back to a balance in this aquarium of starvation.

Human wastes are always a powerful factor in the dissemination of filth diseases, whether the faeces are diluted and used in liquid form, as is done in the south, or dried and mixed with ashes from the kitchen and manure from the stable as is the northern custom. A few eggs and pathogenic germs may be killed during the storing and curing of the fertilizer, but "millions of worm eggs, billions of protozoan cysts, and trillions of pathogenic bacteria survive and are transported to the fields", where they quickly infect the Chinese either through their laborious hands, always in such intimate contact with the soil, or by way of their mouths, always avid for the products of this polluted soil. Dr. Winfield calculates that some 4 million people die in China every year as a result of this contamination by human excrement; this is almost a third of the total deaths, and double the losses in the bloodiest years of the Sino-Japanese war.

The specific hunger for iodine is common in the mountainous central provinces, Yunan, Sinkiang and Tibet. According to Dr. James Claude Thompson of the University of Nanking, more than 25 per cent of the local inhabitants suffer from goitre.

Vitamin deficiencies are very frequent, although in view of the scanty and monotonous Chinese diet, they are not so common as one would at first expect. The Chinese have always used small quantities of certain products—leaves, oil, seeds and roots—which supply these essential elements to a certain extent, particularly since the foods are prepared by a quick cookery which tends to preserve the vitamins.

The most common of the typical diseases caused by vitamin shortages is undoubtedly beriberi; it is most common in the south where the rice is milled and polished and thus robbed of its vitamin B_1. There are no reliable statistics as to the incidence of beriberi, but Dr. T. P. Kuo notes that in 1937, out of all the patients admitted to hospitals in the great cities of China, between 3 and 4 per cent were suffering from beriberi, and that this percentage rose to 15 during the Sino-Japanese war. Xerophthalmia and pellagra abound in China too, but there are no available figures.

These are the principal specific manifestations of the starvation that regularly ravishes this part of the world. There are many indirect consequences of nutritional poverty in this immense human mass. Hunger is in large part responsible for the shocking figures on overall mortality, on infant mortality and on life expectancy. China's death rate of some thirty per thousand is the highest among the larger nations, and her infant mortality of about 160 per thousand is among the highest in the world. The life expectancy in China is only 34 years, compared to 60 in the United States and 65 in New Zealand. The only country with a lower life expectancy figure than China's is India, where the average life span is only 26 years.

As if this lurking tragedy of chronic hunger, with its continuous degradation of Chinese life, were not enough, there come from time to time great natural disasters which throw this long-suffering people into the clutches of famine. No country in the world boasts of so many natural agencies for the affliction of man as does China. Droughts, floods, locust plagues, earthquakes, cyclones—these are the habitual instruments with which nature periodically eliminates some millions of the Chinese population. Since the Chinese people live continually on the verge of falling below their minimum needs for subsistence, with never an opportunity to accumulate reserves, every natural cataclysm which breaks over the land brings immediate black starvation, mass killing and mass exodus from the afflicted area.

The most terrible famines in China, according to the historical record, have resulted from the great droughts. A statistical tally of these disasters has been compiled by Alexandre Hosie; out of the thousand years from A.D. 620 to 1620, 610 were drought years in one province or another and 203 of these were years of serious famine. In at least 15 of these famines the Chinese gave in to the pressure of hunger and used human flesh for food. Droughts occur most often in the broad, semi-arid plain of the central and northern part of the country.

Next in frequency as a cause of famine in the Celestial Empire are the floods, which are a problem principally where the great meandering rivers flow through broad alluvial plains. The floods also do tremendous damage in the deltas which they themselves have produced, and where the fertility of the soil has brought about a concentration of the great human anthills of the Orient. The rivers have built up these coastal plains by depositing large quantities of silt floated down from the interior, and the process continues today. The old earthen dykes intended to keep the rivers within bounds have to be built higher every year as the stream beds rise with new deposits of silt. There are a number of rivers in China whose beds are now well above the level of the surrounding plains; as Dudley Buxton aptly puts it, "the rivers are on the plain, not in it." Even so, the rivers break or overflow the dykes from time to time, flooding the fields and villages, destroying the crops, killing humans and animals—and fertilizing the soil, so that when the waters go down the survivors can draw dividends in the form of abundant harvests. That is the Chinese earth, where the Lord giveth and the Lord taketh away, in keeping with the whims of nature and the powerful gods concerned.

Locusts are a third natural cause of famines in China. When the dense swarms of insects descend on a region they destroy absolutely all vegetable life, leaving green and blossoming fields as bare as deserts. Certain provinces suffer more than others, but all China is subject to these plagues. Mallory reports that out of 162 famines on record in the province of Shensi, 20 were due wholly or in part to locusts. When the Chinese peasant is faced with the desperate prospect of his fields completely despoiled and his whole crop eaten by the insatiable grasshoppers, he does the only thing left to keep from starving—he begins to eat the grasshoppers. Thus the Chinese demonstrates again his ability to bow to the inevitable, and to find an escape valve for threatening pressure in his aquarium of hunger.

Although somewhat less destructive of food resources than locusts, floods and droughts, the earthquakes and typhoons which regularly devastate the coastal regions of China are well capable of causing famine, or of aggravating famines originally due to other causes. Impelled by one or another of these natural forces, or by several of them at once, stark hunger comes on and reduces these people to the extremity of physical misery. Fearful descriptions, details more macabre than any facets of famine in the Americas, are the stock in trade of writers who deal in the tragedy of Chinese life. That life is one of utter human degradation, moral as well as physical. Vandalism, invasion of private property, mass murder for a handful of beans and rice—these are commonplaces in China when human senses are lacerated by the sharp needles of hunger. Even cannibalism puts in its hideous appearance. The people dwindle to a mass of living spectres, who lie down to die with that ancient resignation of the Chinese, or else abandon the famine-stricken region in search of places the plague may not have reached.

Departure comes about only after a painful struggle with conscience, and after begging forgiveness of the ancestors for abandoning their tombs. The aged father of Wang Lung, hero of Pearl Buck's *The Good Earth*, although he sees his family starving, practically reduced to eating grass and bark, still exclaims: "There have been worse days—there have been worse days. Once I saw men and women eating children." This dismal idea frightens Wang Lung so that he thinks of leaving. But when speculators from the city, taking advantage of the situation, offer him next to nothing for the soil he loves so much, where his ancestors are buried, and his children who have starved to death, he revolts. He cries out against the brute forces united to break his ties with the sacred earth: "I shall never sell the land! Bit by bit I will dig up the fields and feed the earth itself to the children and when they die I will bury them in the land, and I and my wife and my old father, even he, we will die on the land that has given us birth!" As his children starve before his eyes, however, the fear of death becomes the final argument. Wang Lung abandons all and sets out with his family, so that the name of his ancestors may survive.

When one tries to find out the causes of the constant and imperative hunger that rules China, he is forced to conclude that they are of several types. Although they act and interact, generally speaking, in the most intricate manner, these causes can be systematically divided into two broad groups, the natural and the social. An analysis of the problem of hunger as a whole makes clear at once that the so-called natural causes are only the immediate factors, and are themselves the result of social causes in the background, of factors inherent in the structure of the Chinese economy. It is the tragic and absurd economic organization of the country that leads to its state of permanent nutritional poverty, and exposes it to periodic crises of hunger.

When a natural cataclysm breaks over a certain region and brings starvation with it, study of the mechanism involved will show that the catastrophe is so thorough only because the social environment is especially favourable to the spread of calamity. In the case of the great famines that sweep the northern provinces in the wake of droughts, destruction is widespread because most of the people live continually at the margin of subsistence, without organic or financial reserves, or even local stocks of food, with which to meet any temporary scarcity that may result from drought. And since food surpluses are hardly ever available in other provinces, and transportation is extremely dubious anyway, crises cannot be resolved by outside help.

Similarly it can be seen that the fundamental reasons for the frequency of floods in China are such social factors as the destruction of forests and the neglect of dykes and embankments. If floods were due to natural causes alone, they would be a hundred times more common in Holland, with her concave soil below sea level, than they are in China; floods are rare in Holland because society controls the menace of nature. If the floods, droughts, locusts and other calamities of nature that produce famines in China could not be completely eliminated by the intelligent intervention of man, their unbridled excesses could at least be moderated, and, more important, their effects could be mitigated by means of social organization and the application of human technique. This process may be observed in various parts of the world. Many of the lands that bloom today as a result of the Tennessee Valley Authority were formerly ravaged by calamities like China's. The greater part of California is actually much more arid than the plains of Shantung, Honan and Hopei in north China, but aridity has not prevented California from applying technical measures that have made it the leading agricultural state in the United States.

The peoples of China, far from organizing to combat the violence of their environment, seem almost to have allied themselves with it in such a way as to stimulate and encourage its very excesses. There is no other way to describe the stripping of the forest from the whole country, or the arbitrary utilization of the rivers, in one part or another of their courses, with no regard for the good of the river system as a whole. The abusive deforestation of the Chinese soil is one reason for the fury of the great rivers which, feeling their margins shorn of trees, begin to swallow up the loose and unprotected soil of the valleys, and to take revenge by overflowing their banks. The destruction of the forests cuts down the reserves of humidity in the soil and even, according to some authorities, reduces regional rainfall, thus co-operating to intensify the droughts. The Chinese have busily destroyed their timber down through the centuries to the point where today only 8 per cent of the national territory has a forest covering. Thus such observers as H. D. Fong agree that they have greatly increased the likelihood of droughts and floods, and aggravated their effects.

China's supposed overpopulation is without doubt the most notable of her strictly social characteristics and the one that apparently contributes most toward keeping the country in a state of starvation. The excess of people in China seems, on the face of it, so striking and obvious, it appears to exert such terrific pressure on the land, that superficial observers attribute not only hunger but all of China's difficulties to this one source. More thoroughgoing students too, have been so impressed by the phenomenon that they have considered it, if not the only factor, at least the most important factor of the chronic starvation and undernourishment of the Chinese people. Dr. Walter Mallory, who worked in the years following the first World War on the China International Famine Relief Commission, ended his impressive and well-documented book, *China, Land of Famine*, with this statement: "In the writer's opinion it is overpopulation that constitutes the fundamental reason for the recent famines in China."

It seems to me rash to assert that hunger in China is primarily due to overpopulation when the demographers have not yet been able to fix a clear definition of overpopulation. The experts do not even agree about what an ideal population, an optimum number for individual and collective well-being in any given area, would be. China, moreover, even in the light of the somewhat indefinite principles of current demographic science, turns out to be far from one of the most densely populated countries in the world. In the nation as a whole, there are about 104 people per square mile, whereas Holland and Belgium, which are practically free of hunger in peacetime, have 686 and 725 inhabitants respectively for every square mile. The critical factor in China is not the density but the irrational distribution of the population. On the one hand, there are enormous empty spaces, and on the other, limited areas of shocking concentration, like the section of a northern province where Mallory found an average of 6,880 persons to the square mile.

Obviously, the peculiar distribution of the Chinese population is not caused by its numbers, but rather by the lack of opportunities for employment in the greater part of the country. The imbalance between the number of individuals and the number of available jobs gives the impression that there are too many people, so that some parts of China seem like human anthills. New York with its 7 million inhabitants seems deserted in comparison with Shanghai, where there are only some three million. The difference is that in the Oriental city there are hundreds of competitors for every little bit of work. When the foreigner, outside his hotel, calls a coolie to deliver a message or a package, he is besieged by a regular swarm of applicants in avid competition for the modest task. The truth is that the strange distribution of the population, which gives the country the appearance of being overcrowded, is the direct result of its elementary economic organization. China is limited to virtually one type of economic exploitation—agriculture—and even this is confined to certain areas only, and restricted by primitive methods. Thus when we examine the functional demographic density in China, the index turns dangerously upward; according to John Buck, there are 1,541 individuals for every square mile of cultivated soil.

It might be expected that there are natural causes for this concentration in limited areas while the rest of the country is deserted.

Scientists and students of the Chinese problem, however, find that this is not the case. In the greater part of China there are rich and varied natural resources which, if they were developed, could make possible a better distribution of the population and put an end to all symptoms of overpopulation.

China's agricultural resources, which have been very slightly utilized up to the present time, are an outstanding example of undeveloped possibilities. Dr. O. E. Baker, of the United States Department of Agriculture, stated in an article published in 1928 that there are 700 million acres of land in China fit for agricultural cultivation, but that of these reserves only 180 million were then in use. If the present cultivated area of China is estimated at 220 million acres, there still remain more than two thirds of her natural reserves, unused and undeveloped. I shall explain later how it is that a people living in chronic starvation fails to exploit these precious agricultural resources.

Besides land for farming, China has many other natural resources which, if properly developed, could expand her economic frontiers, now marking off about a third of the country, to make them coincide with her geographic borders. China's wealth in coal and other minerals, and her enormous potential water power, could well support an extensive industrialization. One of the elements necessary to such an economic revolution is a labour supply large enough to mobilize the riches which have slept for thousands of years in her soil and subsoil. Considering that the geographic picture shows a country which needs above all to be exploited and economically mobilized by human labour, it seems a bit precipitate to speak categorically of overpopulation and to insist on the necessity of limiting natural population growth by all possible means. Furthermore, as I have said before, there is no way of limiting the growth of the Chinese population without first changing the whole economic and social structure of the country. I shall try to prove this with objective facts.

China's high demographic potential is a feature of her cultural organization, and it cannot be eliminated independently of the other features that go to make up the face, the individual expression, of that culture. Any attempt to prescribe neo-Malthusian measures as a means of alleviating Chinese hunger will be lacking not only in scientific justification but in social effect, since it will not awaken the slightest response in the Chinese masses. In this closed economic system, with the interdependence of a balanced aquarium, no one dares break a single link of the natural chain for fear of terrible consequences. In such a system, everything must be changed at once, or nothing at all. This applies not only to moral commandments, beliefs, and popular customs, but to material progess as well. It is impossible to end the misery and poverty of China by applying isolated measures. Any such attempt would either have no effect at all, or would make the situation worse by upsetting the delicate balance of the aquarium.

Human life in this part of the world is so directly dependent on natural phenomena and ancient custom that nothing can be changed without a compensatory change in all the other links of the chain. For example, there is the question of improving the country's health conditions by eliminating the principal carrier of faecal-borne diseases, that is, the human excrement used as fertilizer. In his book, *China, the Land and the People*, Dr. Winfield shows how indissolubly this method of fertilizing is connected with the economic structure of the country, and how difficult it would be to alter the custom without altering the whole structure of national life. As things are now in China, there are no other fertilizers available to the farmer in any quantity, and he simply cannot get along without the use of human faeces.

The dependence of the Chinese people on human wastes is so complete that along the roads in certain remote parts of the country the traveller finds special pavilions where suggestive, poetical inscriptions invite him to rest awhile, and leave his small, personal contribution of organic matter in the receptacle provided, for the sake of the regional soil. The same traveller may be amazed as he approaches the cities to see the belts of greenery that girdle them. This wealth of vegetation is owing to the abundance of fertilizer in the cities; the sale of this material is actually one of their chief sources of income. Twenty years ago, Adam Warwick says, the International Settlement in Shanghai used to collect $31,000 in gold every year in exchange for a monopoly of the garbage collection, which amounted to 78,000 tons of waste from the sewers for sale to the surrounding farms.

Since human excretions are so tremendously important as manure, some way ought to be found to destroy the dangerous parasites and bacteria they contain without injuring their value as fertilizer. Unfortunately, all the methods which have so far succeeded in sterilizing the product also free a good part of its nitrogen, thereby reducing its value considerably. After long experiments, the American technicians Stanley Wilson and Gerald Winfield came to the conclusion that if human faeces were treated by composting, mixing suitable quantities of "night soil", animal manure and vegetable matter, the pathogenic organisms would be killed and the product rendered harmless. To use this method, however, 20 per cent of vegetable matter must be added to the human excrement, and this is more vegetable matter than the country has available. Vegetable materials are used up either in feeding draught animals or as fuel for the kitchen; the shortage of wood in China, and the low coal production, which amounts to one-sixtieth of the production per capita in the United States, make plant wastes valuable as fuel. As Dr. D. N. Rowe points out, crop residues, leaves and grass cannot merely be thrown on compost heaps. Winfield judges that in order to bring the compost method into general use it would be necessary to increase the country's vegetable resources; this could be done only by reforestation and the expansion of coal mining, with parallel improvement in transportation so as to keep prices down. Thus a minor change in the method of fertilizing the soil would require profound, nation-wide alterations in agriculture, industry and transportation.

What is true in the case of fertilizer holds true for all the other elements that make up the economic and social life of China. It would be futile to try to control reproduction by means of propaganda when biological, psychological and economic patterns all work to make the population bigger and bigger. The uselessness of such an approach is especially apparent if its sponsors hope in this way to put an end to starvation. It cannot be denied that population growth and starvation are intimately related to each other, but not in the cause-and-effect relationship artificially established by the proponents of the theories of Malthus. There is no evidence whatever that hunger results from China's presumptive overpopulation. The biological and social facts point clearly in the opposite direction: it is rather hunger that is the cause, and overpopulation the result. The enormous human masses that characterize certain parts of China are only the by-products of starvation.

3

Growth of population is determined, in the final analysis, by the play between two basic factors: fertility and mortality. Everything that affects the trend of a population does so by means of one or the other of these elements. Since starvation undeniably raises the death rate, it has always been thought that it operated, like wars and plagues, to retard the growth of population. It seems highly paradoxical, then, to say that hunger, far from leading to *de*population, tends to bring about *over*population.

My statement, however, is based on a series of fully-demonstrated facts. First, it is a matter of common observation that, following periods of calamity, famine and pestilence, populations always increase their rate of growth. It is also clearly observable that the countries on the lowest nutritional level, where millions of people regularly and "normally" starve to death, are also the areas of most violent increase in population: China, India, Egypt, and various Central American countries. On the other hand, the countries at the highest nutritional level show unmistakable evidence of early population decline, with births barely equalling deaths. That is the case in Australia, New Zealand and the United States.

That paradox is explained by the fact that while hunger as a social phenomenon increases the death rate, it increases the birth rate even more, so that the net effect is to speed up the rate of population increase. It is commonly noted that the undernourished classes are the most fertile; the ancient Romans had a word for those who, on a starvation diet, had many offspring, or *proles*—"proletarians". There is a popular saying in Latin America that, "The table of the poor is meagre, but fertile is the bed of misery. . . ."

In spite of these significant commonplaces, however, speculation on the question of population growth has generally followed the line that food scarcity is associated with population decline, or reduced rate of growth, while abundance of food has been held to determine more rapid growth. That has been the established opinion, although toward the middle of the last century there lived one philosopher and demographer who thought otherwise. Thomas Doubleday, reacting against scientific conservatism, undertook a systematic description of the manner in which lack of sufficient food increases the rate of population growth. In an essay which has been completely forgotten, "The true law of population shewn to be connected with the food of the people," he wrote, in 1853, these prophetic words:

"The GREAT GENERAL LAW then, which, as it seems, really regulates the increase or decrease both of vegetable and of animal life, is this, that whenever a *species* or *genus* is *endangered*, a corresponding effort is invariably made by nature for its preservation and continuance, by an increase of fecundity or fertility; and that this especially takes place whenever such danger arises from a diminution of proper nourishment or food, so that consequently the state of depletion, or the deplethoric state, is favourable to fertility; and on the other hand, the plethoric state, or state of repletion, is unfavourable to fertility, in the ratio of intensity of each state, and this probably throughout nature universally, in the vegetable as well as in the animal world; further, that as applied to mankind this law produces the following consequences, and acts thus:

"There is in all societies a constant increase going on amongst that portion of it which is the worst supplied with food; in short, amongst the poorest.

"Amongst those in the state of affluence, and well supplied with food and luxuries, a constant decrease goes on."

Doubleday's theories, unfortunately, did not become widely known. Official circles rejected them for various reasons, of which the most powerful was, according to the canny observation of Raymond Pearl, that "he offended the sentimental susceptibilities and moral judgments of the early-Victorian middle and upper classes". And since Doubleday could not muster enough facts to prove his intuitive assertions, his whole theory was forgotten. There was another striking victory for the taboo that has made hunger a forbidden subject!

Today, however, the supporting facts are at hand, and we can risk a collision with Victorian prejudices and neo-Malthusian theories. It is high time to challenge a point of view which, inspired by economic or political interest, regards as a natural human condition what is in fact the result of social factors.

In the chapter analysing the various disguises under which hunger ravages mankind, it has been pointed out that a certain type of specific hunger, the hunger for proteins, can cause a high fertility index in both man and animal, and that liberal doses of protein rapidly bring that index down. The table, arranged by countries, showed the correlation between daily protein and fertility and indicated the rule: the lower the protein in the diet, the higher the fertility. In a country like China, where protein consumption, particularly consumption of animal proteins, is extremely slight, this specific hunger constitutes a biological factor of high fertility, with a consequent permanent tendency toward overpopulation.

The notion that lack of protein stimulates fertility is not merely a hypothesis that happens to be borne out by the facts. Enough is known about protein metabolism so that we can trace the actual mechanism by which protein deficiency leads to increased fertility, while an abundance of protein has the opposite effect. A detailed explanation of this process is beyond the scope of this book, but I should like to outline its fundamental points in order to clarify the scientific basis of certain of my assertions.

Biologically, fertility depends on the function of organs whose action is regulated, in large part, by hormones, which are the secretions of certain ductless glands. Fecundation in women is closely related to the functioning of the ovaries, to the production of their hormones, particularly the oestrogens, and to the quantity of these substances present in the blood and internal organs.

It is known that there is a direct connection between the functioning of the liver and the ovaries, the role of the liver being to inactivate the excess oestrogens which the ovaries throw into the blood stream. Fatty degeneration of the liver and the tendency to cirrhosis are, as we have previously seen, some of the characteristic results of protein deficiency, and are very common in the Far East and in certain tropical areas of other continents. When degeneration of the liver occurs it begins to operate less efficiently, and is less effective at its job of inactivating excess oestrogens. The result is a marked increase in the woman's reproductive capacity.

The total reproductive capacity of an organism—its fertility—

is the result of a series of physiologica was anything to eat he
animals such as man, it depends on the produwithout. Wang Lung
the ovary, on its fertilization and its developmen in the hour of
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of this hormone within the body.

It is no longer necessary, then, to imagine that by some obscure and mysterious process Mother Nature speeds up reproduction when the species seems threatened with extinction. The mechanism of animal metabolism which maintains this functional equilibrium is complex but not at all mysterious: protein deficiency leads to deficiency in the functions of the liver; this results in a reduction or loss of the liver's ability to inactivate oestrogens; the excess of oestrogens increases the woman's fertility. Then, too, we have examined the psychological mechanism by which chronic hunger intensifies the sexual appetite at the same time that it lowers the appetite for food, and the assistance this process gives in maintaining a high birth rate among the hungry peoples of the world.

Parallel with these biological processes, there is a complex social mechanism through which chronic hunger works powerfully toward speeding up population growth. In China, the most vivid effect of hunger on the economic and social structure is the sharp limitation it imposes on individual production. Constant chronic starvation has so incapacitated the Chinese people that the farmer feels himself unable, through his own labour, to make the soil produce enough food to nourish him. John Buck's estimate that the Chinese farmer produces only one-fourteenth as much as the American farmer has been previously cited. Poor health, limited muscular energy, and, above all, rapid tiring due to nervous fatigue, hold labour productivity down so low in the Far East. All these are the results of hunger. No matter how tiny his scrap of soil, the Chinese feels that the starved muscles of his arms cannot force the land to produce its utmost. His inadequacy becomes a pressing problem in his economy: first, he must get hold of some land on which to raise food to keep from dying of starvation; then, he must arrange for additional workers to help him. An urgent and permanent need for help is at the bottom of the ardent Chinese aspiration to have many sons—new hands to help him in the struggle against starvation.

When Chinese religion and philosophy, Buddha and Confucius, glorify the large, patriarchal family closely linked to the land, they are sublimating and giving moral justification to an economic necessity. The economy of hunger to which the Chinese people are subjected has more bearing than might at first be supposed on the

neir religious beliefs and moral codes.
and moral judgments ophy could not exist," writes a disciple of
classes". And since nic situations did not make it possible for them to
prove his int n without being historical materialists, we are obliged
There was ze the force of economic necessity in the structure and
hunger a f religious doctrines. Roger Bastide is entirely right in
Today, ho that "man is not only spirit; he also has a body, and
biological necessities that must be satisfied," and that "religion is often no more than a strategem of the instincts in search of satisfaction."

The doctrines of Confucius would not have penetrated and taken such deep root in the soul of the Chinese people if his precepts of love for one's family and worship of one's ancestors had not coincided with the people's economic interests and satisfied so fully their most intimate aspirations. The religious principles prescribe large families to worship and carry on the family name, and then tie them to the ancestral soil, thus serving the needs of a family head wonderfully well, guaranteeing him a supply of labour to work his soil and attend to his needs. The open preference for sons is evidence that what is wanted is a labour force. Sons are really welcomed; daughters are merely tolerated as a hazard of nature. Sons alone are responsible for the duties and rites of ancestor worship. Preference goes to such extremes that girl children are often neglected, and more girls consequently die in infancy than do boys. Statistics gathered by the China Rehabilitation Commission show a clear excess of men over women in the adult population.

The idea that a large family of sons is the indispensable base for broadening production leads the Chinese, otherwise so spiritual, ascetic and moralistic in their habits, to tolerate and even prescribe early marriages and the practice of keeping concubines. A number of women are established in the house of one patriarchal chief to further his desire for a big family.

The nutritional poverty in which the Chinese live allows no accumulation of reserves for rainy days or for old age, and there is consequently a common wish for many children as a kind of insurance against future want. Mallory writes that a large family with many sons constitutes "the old-age insurance policy of the Chinese." Western law compels the payment of an insurance policy at the proper time; religion in the East requires the sons to repay the debt they incurred when their father did them the service of begetting them. Rarely do they fail to fulfil this duty, putting the interests of their parents ahead of their own and those of their children.

Pearl Buck, in her superb documentary novel, *The Good Earth*, shows Wang Lung, his whole family threatened with death by famine, giving what little food is left to his father. "As for the old man, he fared better than any, for if there was anything to eat he was given it, even though the children were without. Wang Lung said to himself proudly that none should say that in the hour of death he had forgotten his father. Even if his own flesh went to feed him, the old man should eat."

The need for hands to grow food, thus fending off the chronic hunger, and the need for hands to help in the terrible hours of famine, have built up a whole complex social structure favourable to a high birth rate. Hunger leads to a very high death rate; half the children die before they are adult, and death is always watching his chance for mass attacks. The death rate, too, explains the tormented desire of the Chinese for a large family. He must have an ample excess of sons, so that after they have been cut down by disease, plague, famine and war, there will still be some left to work the soil and worship the name of his ancestors.

Those are the underlying reasons, biological and economic, that make the Chinese one of the most prolific peoples in the world and that, taken in conjunction with geographical conditions lead to relative overpopulation. Admittedly these deep reasons may well seem absurd and paradoxical to people outside the "aquarium", breathing a different air, on a different soil, under a different sky. To them, the love of the Chinese for his children and his veneration for fertile motherhood must seem as absurd as another Chinese weakness—that of raising dogs, when there isn't enough food to go around for human beings. Mallory says that there is probably not a "leaner, fiercer, more pitifully neglected collection of dogs" in the whole world than is raised in the rural zones of China, but they, too, have their excuse for existence in the aquarium of hunger. Here is how the Chinese put it: "The dogs always find something to eat, and when we can't find anything else to eat, we can eat the dogs."

In view of these motives, the popular notion that hunger in China is due to overpopulation clearly puts the cart before the horse. The 500 million Chinese could have a life absolutely free of hunger if they were physically capable of work, if their nutritional and hygienic conditions allowed them to make use of the geographic potentialities of their country. Solution of their problem would not only require agricultural expansion into new areas that could be made tillable by such technical means as irrigation and chemical fertilizers, but also industrial development of mineral reserves. The Chinese are not hungry because there are too many people, but because there is too little production. John Buck's studies led him to conclude that Chinese agricultural production is low because the farms are exceedingly small. I think, however, that we have to look farther for original causes. The farms are small because the Chinese farmer, even with the help of his family, is incapable of cultivating a large area. An insignificant scrap of earth drains all his available energy.

Chinese agriculture began as an oasis culture, the cultivation of small areas of high fertility. And so it has continued. Chinese farming communities developed in isolation from each other, each group concerned only with the intensive exploitation of its own oasis. When the population of these centres grew beyond a certain point a healthy social structure would have led to the adoption of other methods—extensive rather than intensive—but instead, the Chinese went on following the primitive routine, and now are paying the biological penalty. They have insisted on continuing a type of cultivation more like gardening than farming, and have left great areas unoccupied because they could only be worked by a different system. These areas are not even used for other economic purposes, for raising stock or forests. Perhaps this lack of initiative, or excessive conservatism, of the Chinese is just another result of hunger, another sign of the low vitality of a race perpetually starved.

4

The primitive structure of Chinese economy was an ideal vehicle for famine in the first place, and contacts with the West, and the increasing western influence, rather than improving the situation, have made it worse. For the last hundred years, as Schuman points out, China has been the stage for tremendous underground struggles between the great imperialist powers to settle which of them was to establish its hegemony in the region. When the treaty of Nanking in 1842 brought the so-called Opium War with England to an end, China was forced to open her doors to western influences. From that day to this she has never succeeded in escaping colonial status. The American geographer, G. T. Trewartha, puts it very well when he says: "While China has not been a colony of any single power, it was nevertheless exploited by several and was not master of its own house. Like other colonial regions of exploitation, the ambition of the white master was to obtain large profits; the welfare and development of the native populations was of secondary importance."

In keeping with this policy of colonial exploitation, the great western powers, joined in 1895 by imperialist Japan, have worked to keep China in a state of semi-feudal, agrarian backwardness favourable to their colonial designs. Throughout the last century of Chinese history the imperialist powers have continually placed obstacles in the way of the agrarian reform that would increase food production, and opposed the industrialization that would modernize Chinese economy. By using their influence to disorganize the traditional forms of economic life, without introducing industry to take their place, the western powers have increased the pressure on the soil and the fragmentization of the land. They have thereby strengthened the hand of starvation.

It has always been said in the Occident that the decadence of China is due principally to the lack of national unity. But the fundamental fact is always left out: the fact that this national disorganization has been encouraged and lovingly tended by the imperialists. Every time the country has tried to rise out of its chaos of misery it has run into insuperable obstacles in the form of western interests, for whom the "Monsoon Realm" has been, according to E. R. Hughes "the most important focus of profitable, exploited colonial empire anywhere on the earth". It is true that the western countries have "aided" the Chinese with religious missions, and they have exported scientific missions which have tried to improve Chinese health—which have tried, at least, to keep the Chinese from sinking altogether out of sight, so that this magnificent potential market of 500 million customers for western industry should not wholly disappear.

The same self-interest, on the part of each of the great powers separately, has saved China from being completely swallowed up by any one of them; every time one opened its mouth the others bristled and bared their fangs. But the quarrel was all in the family, after all, and a division of the prey could be worked out among gentlemen. The Treaty of Versailles was such a gentlemens' agreement. China was represented at Versailles, but refused to put her name to the dismemberment of her territory in favour of Japan. A similar case was the Washington Conference, called by President Harding in 1921 for the purpose of buttressing the *status quo* in the Pacific, including the foreign concessions and the Open Door policy that subjected China to western mercantilism. To maintain the *status quo*, it was obviously necessary to maintain the status of starvation in the young Chinese Republic, which had just been established under Sun Yat Sen by a revolution with the idealistic aim of abolishing misery and hunger. This was the issue which brought a split between the leaders of the new China and the governments of the western powers. Sun Yat Sen and his Kuomintang appealed to the great western nations for support in promoting Chinese economic recuperation, but, according to the documented study of three American historians, F. P. Chambers, C. P. Grant and C. C. Bayley, "unfortunately these Powers were not too inclined to give them sympathy and help".

Abandoned by the capitalist countries, Sun Yat Sen turned to Soviet Russia, which was thus able to increase its influence in the Far East. So began the bitter struggle of the Kuomintang against the imperialism, feudalism and militarism that were smothering the Chinese economy. The only possible strength for such a struggle would have to come through agrarian reform, replacing the wooden plough, the bamboo rake and the water wheel by modern machinery and scientific agriculture. This kind of progress required capital and technicians that the Nationalists did not have. They needed help. When Chiang Kai Shek first rose to power, after the death of Dr. Sun in 1925, he followed the existing policy, trying, in more or less close collaboration with the Soviet Union, to develop an effective programme for raising the living standards of the Chinese people.

This was the phase of Nationalist policies when four-year-plans of economic recuperation were drawn up. The statement of purpose of the first of these plans, prepared in 1933 by the then Minister of Industry, Chen Pung Po, is quoted in Maurice Lachin's book:

"From a territorial and racial viewpoint, China is a single people, but the same cannot be said of her economic and political structure. A nation may be unified by military, political, or economic forces. My experience leads me to think that genuine unification should be sought through economic factors. It is not my position to judge whether feudal hangovers still exist in China, but there is no doubt but what the economic configuration of the nation is deformed by economic elements of a feudal type. And only by the destruction of that feudalism can China become a modern state."

Chen Pung Po's plan called for the agricultural and industrial development of the Yangtze valley, which was then to serve as a model for the economic reconstruction of the whole country. There were many good reasons for the choice of this area, the principal consideration being that the Yangtze, 3,200 miles long, passes through six of the most fertile provinces of China, where half of the country's population is concentrated. The western powers, however, were frightened by the possibility of Soviet collaboration, and proposed to furnish all the aid necessary for the economic reconstruction of China. Under their pressure, Chiang Kai Shek sought to turn the Kuomintang toward an alliance with the Occident.

It soon became apparent, however, that the promised aid would never reach the rural areas, where the forgotten farmer continued to starve as usual. The western loans were expended on military installations, strategic roads and fortifications to keep the Nationalists in power, much more than they were used to stimulate production. As a result, the Communist opposition gained in strength, and the country was again divided in two as it had been during the first years after the 1911 revolution. The Communists won prestige during the war with Japan. Today they dominate all China, modifying the economic structure of Asia and thus the economic balance of the world.

Some people seem to think that Soviet infiltration and material aid are the principal explanation for the victories of the Communist over Chiang Kai Shek's troops. It is my impression that there is a more profound reason. The Communist revolution is winning in China because, although Chiang Kai Shek has a powerful ally in the United States, the followers of Mao Tse Tung have a still stronger ally. That ally is hunger. For a long time the western powers thought that starvation was *their* ally, because it regularly killed off some millions of Chinese and thus held in check the Yellow Peril. It now becomes clear that they were wrong. The forces of Chiang Kai Shek collapsed because he fought on the side of continued starvation, against the interest of his own people, while Mao Tse Tung has sought to lead his people in a struggle to end starvation. The fear of famine has been the great recruiting agent of Mao Tse's armies, and the decisive factor of the Chinese civil war has been the strategy of starvation.

I cannot believe that the Chinese, whose age-old traditions have always been proof against the religious and philosophical doctrines of the Occident, have suddenly succumbed to Marxist ideas or to propaganda from Moscow. The successes of Communism in China, in my opinion, are due to the fact that its principles coincide in practice with the profoundest aspiration of the people, freedom from the threat of starvation. Starvation is in turn a result of imperialist exploitation of man and the soil. No one can deny that this Chinese hope is an exceedingly natural one, and that its frustration has been nothing less than inhuman.

American observers in Communist China have reported that Mao Tse Tung's most enthusiastic partisans are the 50 million peasants to whom he has distributed land. These people are former share-croppers who used to turn over 40 to 60 per cent of their crops to the landlords.

It is important here to point out that although the land is worked by peasants tilling microscopic plots, a large part of it is owned by the proprietors of huge feudal estates. It is estimated that in the south central provinces, 3 per cent of the "farmers" hold a monopoly on 45 per cent of the cultivated land. This would seem to indicate that the prestige of Mao Tse Tung is a result of his identification with the most pressing needs of his people, rather than of his presumed obedience to Marxist philosophy and to orders from Moscow. Certain observers insist that Mao is far from being an orthodox Communist, deciding the political problems of China according to an inflexible party line. They say that what distinguishes him from other leftist leaders is that although he may be Communist on the surface, underneath he is pure Chinese! His Marxism is impregnated with the philosophy of Confucius. The great human masses that formerly made up his guerrilla forces, and that today constitute his regular armies, were not moved to join up by intellectual arguments or theoretical ideas; they came for reasons deep in the flesh and blood of the people, and because they burned with a desire for better conditions of life.

Never before has the world been so dependent on what happens in China. If this gigantic body of human beings finds a way to survive and to raise its living standards, the pressure on world economy will be relieved for a long time to come. But if China goes down in a shipwreck of misery and destruction, she is likely to pull the rest of the world down with her.

5

The over-populated subcontinent of India, with 20 per cent of the world's population concentrated on only 3 per cent of the world's surface, appears at first to be a living argument in favour of neo-Malthusian theories. The fact that her 450 million inhabitants live in a state of chronic malnutrition, besides being subject to periodic famines, the still more alarming fact that this tremendous mass of people has in recent years been expanding at the rate of 40 million per decade while food production has remained more or less stationary—these seem to be evident signs that the country is marching toward inevitable catastrophe. Total annihilation would appear to be the only solution to India's tragic and irreconcilable dichotomy between Malthus's two factors of alimentation and population.

Yet even here, in the very region picked by the neo-Malthusians as a demonstration area for their doctrines, they are right only in appearance, and before all the facts are in. When population and production are considered separately, as though they were independant variables, there is no way to avoid the conclusion that Malthus was right. But if we analyse the Hindu nation as a social-economic whole, as a living organism whose functions are interdependent, as is actually the base, we find no natural or inevitable justification for the misery in which these people live or the state of hunger in which they die. The desperate situation in India can be explained neither by the shortage of land nor by the excess of people. The reign of starvation in India is upheld by elements disguised and hidden in the complexity of this people's social-economic life. Reasons are to be found that explain the situation more satisfactorily than the neo-Malthusian theory.

In order to understand the background of India's social-economic structure, with its grave deficiencies, it is necessary to have a clear idea of certain geographical factors. In many respects, India can be considered a continent in the same sense that Europe is. It is larger than Europe, and shut off from the rest of Asia by the wall of the Himalayas, which make a much more definite boundary than the indefinite eastern frontiers of Europe. The races and languages of India are fully as various as those of Europe. Continent, subcontinent, or mere peninsula, India constitutes a cultural world of unmistakable individuality, isolated as it was for dozens of centuries by the natural frontiers of impassable mountains and mighty oceans.

Within her area of about 1·8 million square miles, India includes three geographical regions that are well differentiated, and that have very different economic possibilities. In the north is the great Himalaya Mountain chain; in the southern point is the Deccan plateau, crossed by low mountains; and in between are the vast fertile basis of the Ganges, the Indus, and the Brahmaputra.

The region of the Himalayas, mostly covered by dense forests, is unfit for agriculture, and is only thinly populated by primitive peoples that live by harvesting the products of the jungle. Although the soils are poor in the Deccan plateau, agriculture is possible in the valleys and on the gentler mountain slopes, where terracing and irrigation from artificial reservoirs are used. However, this type of farming, which depends on the domestication of water, has not attracted a large population.

In the geologically recent alluvial plains of the central part of the country, where the soil is rich and rain frequent, or irrigation easy, the great masses of India's population are concentrated. More than half of the inhabitants of India are settled on these alluvial belts of the north, which occupy only a fifth of the total area of the country. There is also a high population density in the low and humid lands to the east and to the west of the Deccan plateau. In contrast with these swarming centres which reach a density of more than 1,000 persons per square mile in the Ganges valley, India has extensive areas, such as the Thar desert and the Naypur plateau, that are practically unpopulated.

Variations of climate as well as of soil produce India's irregular distribution of population. Lester Trueblood, the geographer, says that in no other part of the world is there such a pure type of monsoon climate, and that nowhere else are people so dependent on climatic conditions. The rain pattern is determined principally by the winds, which come in from the oceans laden with moisture. Their paths and their intensity are of fundamental significance to this predominantly agrarian people. The distribution of rain is extremely irregular in the Indian peninsula; there is a mean annual rainfall of 451 inches at Cherrapunji, in Assam, making it one of the rainiest places in the world (drier only than Mount Waialeale, in Hawaii, with 460 inches), while in certain parts of the Thar Desert it hardly rains at all.

More than three-fourths of the population is engaged in agriculture. The Hindus, whose religion prohibits the use of meat, particularly beef, as food, have developed a type of diet which is overwhelmingly vegetable in origin. Rice is the basic food, although it is cultivated on only 25 per cent of the total tilled land. Sorghum, millet, wheat and lentils, although consumed in various parts of the country, are considered to be complementary foods. Rice is the largest crop, yielding annually some 40 million metric tons, but India also imports quantities of this cereal.

In the greater part of the country rice is eaten with vegetables and with small quantities of vegetable oils and fish. A favourite rice dish is mulligatawny, a kind of rice soup cooked with onions and seasoned with good doses of pepper and garlic. Rice with curry sauce, which gets its hot taste from various seeds and leaves, is another habitual dish. Meat consumption in India is extremely low, and practically confined to the Mohammedans. Consumption of milk and its derivatives is equally low; India is estimated to contain half the world's cattle, but they are so badly fed that they produce hardly any milk.

On their scanty and monotonous vegetable diet, it is not surprising that the Indian people are among the world's most undernourished. They show symptoms of the most varied kinds of deficiencies and specific hungers.

The biological structure of the Indians is most seriously undermined by their extreme shortage of high-value proteins; this deficiency sets in motion a series of evils which lead to a shocking decline and degradation of the race. We have noted that the differences in height and physical resistance between the Sikhs of the northern Punjab and the populations of the South are a result, as McCarrison proved experimentally, of the greater proportion of protein in the Punjab diet. The Punjab diet includes whole wheat bread, milk, milk products and meat, in contrast to the rice-and-vegetable menu of the south. The almost universal absence of good proteins contributes to the Indian's low stature, to his low energy quotient and his susceptibility to disease.

Protein deficiency also bears relation to the frequency of specific diseases. Doctors have long been aware that cirrhosis of the liver is very common among the poorer classes of India, and they have attributed it to malaria and other pathogenic agents which are active in the region. Only recently was it suspected that the condition might be related to nutritional deficiencies. In 1937 Dr. Aykroyd wrote prophetically: "Portal cirrhosis, not associated with malaria or alcoholism, is a common cause of death among middle-aged Indians of the very poorest classes, and it may well be that this condition follows the consumption throughout life of a grossly defective diet." His suggestion has been wholly confirmed. It has become clear through research that the lack of certain elements contained in proteins causes the cirrhosis conditions that carry off so many lives in the Far East.

One further effect of poverty in proteins is a lowering of appetite. The Indians have tried to compensate for this by an exaggerated use of seasonings. Curry, one function of which is to make foods sharp and appetizing, is so widely used that it has come to be called the "salt of the Orient".

Certain vitamin deficiencies are also very common in India. In Orissa province, where N. Singh conducted a nutritional investigation in 1939, it appeared that children in particular suffer from a whole series of vitamin shortages. Col. R. E. Wright, a doctor who was for many years superintendent of the Madras Eye Hospital, has said that disorders of vision due to vitamin B deficiency are more common and more serious in this area than anywhere else in the world. Beriberi also exacts a heavy toll from this rice-eating population. One of its most unpleasant forms is the acute beriberi which strikes suddenly and violently; in the Madras Presidency, according to a report of the Food and Agriculture Organization's experts, this malady is responsible for a "high mortality among infants", especially between the second and fourth months. It is unnecessary to describe in detail the many other deficiency conditions that exist in India; they are the same as those in all the other starving areas of the world.

Chronic hunger in India is without doubt one fundamental cause of the high death rate, which competes with that of China. Official statistics set the death rate for all India at about 24 per 1,000, but Chandrasekhar, the demographer, considers this figure to be far short of the truth. His estimate is 30 deaths per thousand inhabitants. By that reckoning, more than 10 million people die in India every year.

The great tragedy for the national economy is not so much the number of people who die, but the age at which they die. Infant mortality is higher even than it is in China. A quarter of the babies born die in their first year; 40 per cent die before they are five, and only half survive to the age of 20. In that way the pitiful conditions of Indian life eliminate half the human beings that the country produces before they become adult. The effects of this situation on the economy are disastrous; it is as though half the individuals born were defective, having mouths to fill but no hands to work. Half the Indian children are born merely to consume a starvation diet and to die before they are old enough to produce. The Indian's life expectancy of 26 years—less than half that of the American or Englishman, and a third that of the New Zealander—is one striking aspect of this terrible waste of human potentialities.

Hunger and undernourishment alone do not effect this massive slaughter of the Indian people; there is obviously a whole complex of unfavourable health conditions. Yet there is no doubt today that undernourishment lowers the resistance of the organism and prepares the ground for other enemies, especially infectious-diseases, to do their deadly work. The people's susceptibility to disease was amply demonstrated in the 1918 influenza epidemic, which killed between 15 and 20 million Indians. Then too, there are 100 to 200 million Indians who suffer from malaria, and a million die of it every year. Poorly nourished people are easy prey to malaria. Geddes, to emphasize the influence of diet on this disease, has shown that the meat-eating Mohammedans are much less subject to malaria than are the Hindus with their very faulty vegetable diet.

Tuberculosis, cholera, dysentery, worms—all the great killers have their work immensely simplified here by starvation. And every once in a while hunger becomes more than an assistant and itself strikes down human beings on such a scale that it piles up the greatest death rates in the world. That happens in the times of famine, when mortality figures climb as high as 60 out of a thousand.

Famines have apparently always existed in India, but they grew much more serious with the unfortunate intervention of the English in the Indian economy during the nineteenth century. The famines of the early 1800's, according to André Philip, killed off half the inhabitants of Madras, Mysore and Hyderabad. Toward the end of the century more than 20 million people starved to death, four million of them in the one terrible year of 1877, according to Réclus. Famines have become somewhat less severe in our own century, but they are far from vanishing. As recently as the winter of 1942–43, the bodies of the famished littered the streets of Calcutta so profusely that their mere removal became impossible. Osborne reports the observation of an English medical officer who had been there: "The dogs had the best time of it. They would and did eat human flesh before city authorities could carry away the bodies of those who died of famine in the city streets."

6

What are the causes of this permanent state of hunger in India? In two centuries of domination the English did not succeed in alleviating the situation, but in fact aggravated it. Apologists for English policy have attempted to justify the resounding failure of their colonial administration by citing "natural causes" in the face of which man is helpless. The leading causes thus presented (backed with a great deal of expert testimony) were the exaggerated demographic pressure and the hopeless wearing out of the land. Many of the experts have categorically stated that hunger and misery in India are entirely the results of nature's stinginess and of the uncontrolled reproductive appetites of the Indian people. For them India is a living example of the gloomy predictions of Malthus. In their view the nations that make up the Indian Union of today,

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But to know the true importance in India's solieved itself on an
structure of these natural factors that are cited as t when an old
decadence, one must look at the facts. When India joyfully on
of 450 million is compared with her land area, which is af she gave
thirds that of the United States, it can be seen that her y gift he
relative density of 250 per square mile, though not low, is not
the highest in the world. It is exceeded by a dozen counquite
including the relatively prosperous nations of Belgium, Hollaine
and England. What differentiates India's demographic charactt,
from those of densely settled European countries is its rural nature; 87 per cent of the people of India live in tiny villages, of which Cressay says there are close to a million. This rural population collects, as has been noted, in the fertile valleys and on the alluvial plains, and cultivates some 330 million acres of land, 50 million of them by irrigation. Farming only the more fertile and easily watered zones, the Indians have so far left uncultivated an area

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Engthough most of her productive energy goes to agriculture,
theia cultivates only two-thirds of her arable land. And while this
onited area undergoes intensive cultivation, it yields much less than the average for the rest of the world. Italy and Germany, containing more people in proportion to their land, extract an annual return of food from the soil amounting to 1 and 2 million calories respectively for each inhabitant. In India, the individual's yearly share of home-grown calories is only ·8 million, an amount utterly insufficient for minimum needs.

The precarious state of Indian agriculture is apparent from the figures on specific crop production. India raises 14 quintals of rice per hectare while Italy produces 50, Spain 45, Japan 35 and Rumania 24. India's low return from rice cultivation has been attributed to the poverty of a soil situated almost entirely in the tropical zone, but that argument does not stand up against the following facts. First, equally tropical countries have achieved a much larger yield; Egypt has a return of 30 quintals per hectare, Surinam gets 25 and British Guiana 22. Second, much of India's soil, particularly that of the alluvial plains of Hindustan where most of the farming is concentrated, is made up of materials brought down by the rivers from non-tropical latitudes. Thus, although the climate of the Ganges and Indus deltas is tropical, the soil there is composed of elements carried from the temperate zones where the rivers originate.

Low farm income in India is primarily due to primitive methods of cultivation. Techniques are rudimentary. Agriculture is carried on at the mercy of the capricious monsoons, without seed selection or pest control, with crude tools and inadequate fertilizer, mainly cow dung. India's immense herds of cattle estimated at 200 million head, would seem likely to provide a fairly good supply of manure, but the rural population are too poor to use it all for fertilizer. Instead, because wood is scarce and expensive on the tillable plains, the farmers are forced to use cow droppings for fuel. The dung is moulded into blocks and left to dry on rocks or in the back yard. In some areas, fuel is as difficult to procure as food itself. People thus enslaved by their environment find manure the only answer to their fuel problem.

Aldous Huxley tells of a scene which epitomizes the role of manure in the domestic life of the poorest Indians. The novelist was travelling by elephant in the Jaipur region. As he left the palace of a feudal lord his mount stopped in the street and relieved itself on an elephantine scale. Hardly had the beast finished when an old woman dashed out of a nearby shack and hurled herself joyfully on the enormous pyramid of dung. As the elephant moved off she gave infinite thanks to the "Salaam Maharajah" for the princely gift he had left her—it would keep her cook fire going for a week!

Elephants being rare, and such monumental contributions quite unusual, the farmer must get along with his modest bovine briquettes. He burns up 65 million tons of manure, 40 per cent, more or less, of the total annual production estimated to be 160 million tons dry weight. About 20 per cent of the supply is lost because it is not collected, and only 40 per cent of it is left to be used for fertilizing the soil.

Another cause of low farm income is a set of property relationships that make rational use of the soil impossible. About 48 per cent of the cultivated lands belong to large-scale landlords; the great latifundia are owned by some 6 or 8 million of these feudal lords, while hundreds of millions of sharecroppers occupy the land. The great proprietors are business men rather than farmers, and take no interest in agriculture except as a source of their super-profits. They leave the sharecroppers to their fate, and appear only at harvest time, to collect their shares of 40 to 60 per cent of the crop. Since the government takes out another 10 per cent, the worker has very little left to show for his toil. Perhaps this economic situation is a partial explanation of the Indian's lack of enthusiasm, or even distaste, for work. He is aware that no matter how hard he works he will receive almost nothing.

The feudal régime explains, too, the large number of famines which occur when there is in fact no real crisis in food production. The farmers cannot use their own harvests to keep alive, and they are simply unable to buy back the products of their own sweat. It is common practice in India for food exports to continue while great numbers of people are starving to death. Richard Temple tells us that throughout the famine of 1877, when 4 million people died of hunger, exportation of cereals through the port of Calcutta never stopped for a moment. André Philip accurately observes that "famine is not always the result of an insufficient harvest, but rather of an insufficiency remaining to the farmer after the tax collector, the landlord, and the usurer have taken their share."

In addition to the system of great landed properties, called *zamindari*, there is a system of small individual holdings known as *riotwari*. In *riotwari* areas some millions of small farmers work their tiny scraps of soil and pay the land tax directly to the government. These farmers are free of the terrible exploitation of landlords, but other evils prevent them from gaining economic freedom. First, the state collects a higher tax on this type of farm, taking about 25 per cent of the farmer's net income. The government exacts this tribute rain or shine, good year or bad, and the farmer often has to borrow, thus falling slave to the extortionate rates of the usurers.

A second evil of the *riotwari* areas is the extreme subdivision of the land. Among both Moslems and Hindus, the land has been divided by inheritance generation after generation until today the average Indian farm is only five acres. These miniature parcels, each occupied by a whole family, produce an individual agricultural income even lower than incomes in China and Japan.

The work capacity of the Indian peasant is extremely slight, and his low energy limits his utilization of what land he has. The most obvious reasons for this incapacity are chronic undernourishment and low levels of health and hygiene. Careful inquiries have shown that the Indian farmer loses a month each year through attacks of malaria, and that at least a quarter of the rural population work throughout the year in a state of fever. Malaria is not the only disease which sucks these people's blood; worm infestation and dysentery are everywhere.

Such, then, are the dark outlines of the defective social structure which holds down the living conditions of the Indian people. The picture is filled in with the castes, which separate the population into two or three thousand closed compartments, each with its special codes, rights, customs and interests. Religious fanaticism is added to the scene. And then there is illiteracy, still today the condition of 88 per cent of the populace.

7

The modern situation in India can be regarded as a natural evolutionary outcome of her primitive social organization which grew, during the Indian Middle Ages, into a despotic tyranny of the Brahmins over other castes. By the time the English arrived in India the inequalities of Indian life were well developed, but the English must accept a heavy responsibility for their preservation. The British have administered India just as the Indian landlords manage their lands, interested strictly in maximum profits and without romantic preoccupations about the native life.

The Spanish and Portuguese came to tropical regions and took root in the soil, to lay foundations for new nations and new kinds of society; English colonists went to the Orient to establish trading posts through which to exploit native labour. It is no longer denied that English colonization in the tropics has always been merely a matter of administration, but it is still debated whether Britain's extreme mercantilism has ever been of any benefit to the people under her dominion. Impartial analysis indicates that colonization conferred more evil and suffering on the Indians than it did advantages.

The first British colonists arrived in the eighteenth century to find a relatively prosperous country, with a population of 100 million farmers and artisans. India had long since ceased to be a purely agricultural country; it was an important manufacturing centre, exporting finely worked merchandise to Europe, Arabia, Egypt and China. Delicate silks, muslins, laces, embroidery, jewellery and rugs were sent abroad. Père Vatu, in his history, says that India was rising out of her Middle Ages, and her relative prosperity was the product of a transitional economy, moving from a closed medieval system into a nascent factory capitalism. Rural artisans were coming to the cities to work in factories, and laying the foundations for an industrial development which could raise the national income and living standards ever higher. There were still occasional famines, a heritage of the medieval period, just as there were in Europe. But famine was on the way out, and it certainly would have disappeared with the development of industrialism just as it did in western Europe. It was the intervention of the English with their insatiably greedy traders that violently cut short India's economic revolution and forced the country back to a medieval economy and into permanent starvation.

From the very beginning of their occupation, the handful of military and civilian Englishmen who were in charge of dominating and administering the monster colony formed their policy exclusively in favour of British mercantile interests. The activities of Robert Clive, who is considered the true founder of the British Empire in India, were typical of this economic exploitation. Clive indulged in such excesses of oppression and brutality that the English had an attack of conscience and called him home to answer for his behaviour. He won a vote of censure from Parliament and put a bullet through his head, but his successor, Warren Hastings, continued his tradition. Hastings sold, for instance, two Indian provinces which did not belong to the English. He "sold" them to the Great Mogul for 25 million rupees. He then rented out, for 10 million, the services of an English brigade to "persuade" the local governments to recognize the illegal sale. Hastings's administrative acts finally resulted, like Clive's, in a Parliamentary summons, but by this time India had proved so profitable that Parliament, according to a document cited by the historian Gonzalo de Reparaz, acknowledged that he had "acted criminally" but absolved him because "his crimes had been advantageous to England . . . ".

Indian manufactured goods interested the English very much at first. As C. R. Dutt points out in his *Economic History of India*, these goods could be very profitably sold in London for half the price of English products, in spite of transportation costs. The traders soon, however, grew discontented with their considerable profits. They managed, through the East India Company, to monopolize the buying of the most important products, and began to force the artisans to sell at prices so low that they "brought on the complete ruin of Indian industry and commerce." Meanwhile the English government, to protect its growing native industries, started in the early nineteenth century to levy prohibitive duties on Indian imports. These import taxes, which amounted to 60 or 70 per cent of a product's value, were a death blow to Indian manufacture. While British merchandise circulated freely in India, Indian wares were taxed out of the English market—until England had cornered the markets of the world and no longer feared Indian competition.

Here is what Dutt has said about this competition: "The fabrics and silks of India, until 1813, were sold in British markets at prices 50 or 60 per cent lower than the products of British industry, and therefore it was necessary to protect the latter with duties of 70 to 89 per cent *ad valorem*. If this had not been done, the factories of

Manchester would have come to a halt at their birth, and it would have been extremely difficult to rebuild them later. Thus English industry was born from the sacrifice of Indian industry."

When Indian industry was stifled, the class of artisans was completely ruined, and the nation's economic strength shattered. Destruction of the artisans' livelihood had particularly dire effects on the Indian economy since it forced these people to take refuge in agriculture. The rural proletariat thus created increased the pressure on the soil and led to a gradual reduction in the size of rural properties. The proportion of artisans in India fell, during the nineteenth century, from 25 per cent of the population to 10 per cent, while the proportion of agriculturalists rose from 60 to 75 per cent. Hunger took possession of the whole country; the nineteenth was the century of India's most terrible famines.

Throughout the whole history of English domination, the only genuine plan for Indian industrialization ever developed was put forth during the First World War, when imperial survival seemed temporarily more urgent than the lust for profit. Yet it is clear that a well-considered industrial programme would be the decisive remedy for India's misery. India's economic plight is shocking; even today, the average annual income for each individual is $19·00. That is 5 cents a day.

The English could perhaps have been expected to bring benefits to Indian agriculture, but they never did. It is true that they developed a really magnificent plan for expansion, and brought a desert estimated at 20 million acres under cultivation, by means of irrigation. British-built engineering projects—dams and irrigation canals—are as big and as valuable as any English works in India. A single dam in the lower Indus valley waters an area larger than all the cultivated land of Egypt; the 80,000 miles of modern irrigation canals in India are more than exists in all the rest of the world. There is only one thing to be said against this vast agricultural programme; it did not affect the food of the people. Its benefits went almost exclusively to cash crops for export.

So far as subsistence products, crops for domestic consumption, are concerned, the area tilled and the quantity yielded have remained more or less constant for the last half century, while the population has increased by dozens of millions. Sir Azizul Huque, Member for Food, had this to say to the Indian government's Legislative Assembly in 1943, according to a report by the Council of Chatham House:

"The food problem [in India] today is much deeper than it appears on the surface. If statistics are correct, rice production in India during 1911–12 to 1942–43 has remained nearly constant between the figures of 25 million tons and 27 million tons. . . . As compared with the three pre-war years the combined acreage for our basic food crops, rice and wheat, is almost constant, viz., 107·5 to 109 million acres. . . . In the meantime, the population has increased from about 311 millions in 1910–11 to 388 millions in 1941, with the corresponding increase in rice-eating population. The main food grains production of India has remained almost constant between 50–51 million tons with small variations from year to year. . . ."

It does not appear that the English colonial government made any very great efforts to improve the techniques of Indian agriculture. The first step in that direction would have been to raise the educational level of the rural populations, but that was never tried On the contrary, the English in 1830, decreed their own language to be the only one permissible in schools. Far from promoting a diffusion of culture, this language requirement succeeded in restricting it to an insignificant number of privileged students. One result of that simple British dictum was an enormous reduction in the actual number of schools, for lack of English-speaking teachers to teach in them.

In barring the masses from education, the English were, of course, acting in their own interests. All they needed was a small caste of educated Indians to help them administer the rest. This they created, adding still another caste to the thousands in existence. Until the dense, rural masses are raised from the obscure mental climate where they live among their prejudices and their fantasies, it will be indeed difficult to introduce rational agricultural methods to the soil of India.

The English could sensibly have increased Indian farm production through scientific seed selection, and so they did, for such cash crops as cotton, sugar cane and jute. Adequate fertilization, say the F.A.O. technicians, could raise Indian food production by 20 per cent. So far, artificial chemical fertilizers have been used for virtually none but export crops. Intensive use of DDT would make it possible to redeem for agriculture great unhealthy tracts in the Himalayan foothills. Not only that, but DDT could also double human productive capacity in India. As yet, very little has been done with insecticides.

These are the economic characteristics of British colonial policy which go into the balance sheet for India. One is forced to conclude from it that while the English did not invent Indian starvation—it existed as a hangover of the Dark Ages—they did everything they could to preserve it. They tended and perpetuated starvation and the other elements of medieval feudalism in the sacred interest of colonial imperialism.

8

Hunger is a social force capable of leading human societies down strange paths. They blindly rush toward an unknown destination, lured on by the beckoning hope that in some way, somehow, their desperate and torturing instinct to eat may be satisfied.

In the great monsoon realm of the Far East live a singular people, the Japanese, who were driven forward with dizzying speed under the biting lash of hunger, and so skipped over several whole stages in their social evolution. Prolonged and repeated exposure to bitter starvation made them tear themselves violently out of the economic swamp in which, less than 200 years ago, they were sunk in feudal stagnation, and sent them plunging into the most frenzied capitalism, into aggressive imperialism and dangerous adventures for economic and territorial expansion. But the significant thing is that all the bold economic experiments into which Japan threw herself so avidly were nothing but doomed and desperate attempts to break her age-old siege of hunger.

On four large volcanic islands surrounded by a cloud of 4,000 tiny islets, in a total area of barely 150,000 square miles, the Japanese people have lived for countless generations. In the sixth century China extended her cultural influence across Korea and into these semi-barbarian islands, implanting Buddhism and the basic pattern of Chinese civilization. While accepting the benefits of this cultural influence, Japan, by taking advantage of the decadence of China at the end of the T'ang dynasty, soon freed herself from it. Then began a long period of isolation.

Hermetically sealed in her island territory, Japan developed her characteristic type of agrarian feudalism. For seven centuries, in the name of an Emperor descended from God himself, the *daimyos*, or great feudal lords, ruled with a rod of iron. As representatives of the Emperor they owned both the land and the people—the soil to be cultivated, and the peasants to wring the necessary subsistence from it. Each feudal estate was a closed world, with its army to keep order and enforce the will of the *daimyo*, and with its serfs permanently attached to the land. Each estate was a sealed compartment, an economic autarchy, depending on its own serfs for the whole of its needs.

Since three-quarters of Japan is excessively mountainous, only the easily farmed plains areas, which make up about a quarter of the national territory, were occupied. Dietary essentials were obtained by the intensive cultivation of rice in the river valleys and coastal plains, and by fishing, an activity that had been characteristic of the Japanese from the earliest times. Rice was always the basic food; in fact, rice was so basic an element that for a long time it was used as money. Even today, sacrificial offerings of rice to the gods are an indispensable part of all traditional rites and religious ceremonies.

On their diet of rice, supplemented by a little oats, sorghum, millet and fish, the Japanese people were able to maintain a relatively balanced diet in normal times. It was a meagre régime, but without obvious deficiencies. However, let some unforeseen eventuality—abnormal rainfall, earthquake, or civil war—reduce the harvest of one of these feudal domains, and the closed compartment would immediately be drained of food. The result was famine, of the spasmodic type so greatly aggravated by lack of trade and communication.

As in the closed aquarium of China, life in this aquarium had to be rigidly regulated. But many of the moral principles of the Chinese proved inappropriate to local conditions in Japan. Consequently, a new and different moral code had to be created—one which anticipated and went beyond Malthus in its determination to limit, by all possible means, the growth of the population. The leaders of the nation were afraid that an increase beyond certain limits in the number of inhabitants would inevitably lead either to a change in the economic system or to forced emigration, two dangers that the *shoguns*, or military chiefs, were anxious to avoid. The *daimyos* were living quite comfortably, thank you, in their fine medieval castles. They were amply protected by their armies of *samurais*, and had a sufficient number of vassals to work their lands and pay them a fat tribute. They saw no reason, therefore, to let the plebeians become too numerous. Growing hunger might lead to growing restlessness, and the tumult and the shouting might even shake those high seignorial walls. The position of the feudal lords of Japan was extraordinarily like that of certain neo-Malthusians of today, who exert themselves to the utmost to keep the world sufficiently underpopulated so that a privileged few can live like kings. The Japanese policy of population restriction was fundamentally a result of the desire on the part of the feudal lords to preserve the existing set-up—the comfort and privilege of 260 individuals based on the slavery of 26,000,000.

In spite of the high fertility of the people, it was possible by rigid control and by a shockingly high death rate—principally due to periodic famines, internal wars, and epidemics—to keep the Japanese population practically static for four centuries. Among the measures recommended—and widely practised—from the fifteenth to the nineteenth century were: abortion, infanticide (especially of female children), the abandonment to death of aged parents, and the application of the death penalty for almost any crime. A Japanese writer asserts that during this epoch the people thought no more of doing away with extra children than of thinning out a row of beans. In some provinces two out of every five babies were killed, and in others, all beyond three per family. In Hyuga province, the first-born alone escaped. It was by such wholesale slaughter that the Japanese feudal régime kept its power stable, and avoided the universal starvation that was always just around the corner. For two centuries, from the middle 1600's to the middle 1800's, the population fluctuated between 25 and 27 million.

Such was the social and economic organization of Japan, isolated from the world in a bitter struggle for subsistence, when one memorable morning in June, 1853, Commodore Perry of the U.S. Navy breached the inviolable Imperial waters by forcing an entrance into Uraga Bay. With him he carried a letter from the United States government requesting the opening of Japanese ports and the negotiation of a commercial treaty. These "requests" were accompanied by persuasive arguments in the form of ten warships armed with excellent cannon and carrying 2,000 fully equipped soldiers. The Japanese recognized the reasonableness of the requests, and on February 13, 1854, signed a treaty that for the first time opened their ports to the Occident—to western technique, and to western business appetite. Soon similar treaties were signed with England, France, Russia and Holland, and western ideas began to invade Japan.

As a result of their first contacts with the industrial civilization of the Occident, the Japanese discovered that there were less inhuman means of escaping the presence of hunger than the mass assassination of their new-born children and aged parents. The problem might rather be solved by the application of western technical efficiency. This discovery aroused such enthusiasm in the Japanese that they now thought of little else, and they rushed to take advantage of these new methods regardless of cost.

What followed was the concentration of the will of a whole hungry people on one objective: obtaining food. This polarization, according to P. A. Sorokin, absorbs the individual so completely in a frenzy of activity that he is no longer sensible of sacrifice or fatigue. The Japanese people adopted western methods of fighting hunger so quickly and so thoroughly that just six years after the coming of the white men, in 1860, a revolution broke out that abolished feudalism and set up the economic principles and technical methods of the West.

With the death of the old Emperor Komei in 1867, Japanese feudalism came to an end, and with the accession of the young Emperor Mutsuhito, the Meiji era, that was to create modern Japan, began. The first step toward modernization was agrarian reform, which involved the division of the *daimyo* holdings among the masses of peasants, and the introduction of scientific agriculture. Although it was asserted at the time that not an inch of Japanese soil that could be cultivated was left, the tilled area has been noticeably increased since then. A century of rational agrarian policy increased the area of cultivated land from 4½ million hectares to 6 million, an increase, that is, of a third. Today it is estimated that another 1½ million hectares might still be brought under cultivation.

Even more impressive than the expansion of cultivated area is the increased intensity of production achieved through modern scientific methods. In the feudal Japan of 1860 a hectare planted to rice gave an average return of 16 quintals. Francis Ruellan reports that this figure rose to 20 in 1890, 24 in 1910, and 28 in 1930—the production of the pre-scientific period was almost doubled. By adequate selection of seed, and by rational irrigation and fertilization, the Japanese have achieved an average production which is among the highest in the world. They are exceeded only by Spain, Italy and Egypt (64, 47, and 35 quintals per hectare respectively), but it must be remembered that while the Japanese plant their rice in all sorts of soil, these countries raise only limited amounts of rice, and concentrate its production in certain small areas of extremely fertile land.

It was also a striking victory for Japanese agricultural technique that they accomplished this increased production without exhausting their soil. Western technicians state that Japan has reduced losses from erosion more effectively than any other agricultural country. Dennery quotes two American experts, G. Jacks and R. White, who go so far as to assert that for all practical purposes there is no such thing as erosion in Japan.

In order to obtain these remarkable results, Japan put into practice all the agricultural techniques she could learn from the West, and adapted them to the traditional processes of Chinese and Japanese farming. But though these people have always been under pressure to produce more food, they have never robbed and abused their soil, or worked it out in a few years as has been done in various parts of the Occident. In spite of the tremendous pressure of population, great tracts of land have been set aside as insurance against erosion. Foreign specialists have always wondered why Japan, with her shortage of food and particularly of proteins, never took up cattle raising. It could have been done just as well there as in New Zealand, where the topography is very similar to that of the Japanese islands, by taking the same advantage of mountainous lands unsuitable for agriculture. The reason lies in Japan's wise policy of soil conservation, a technique that this country was the first in the world to adopt. Once the forests had been sacrificed to pasture, waters pouring off the slopes with nothing to stop them might well have done tremendous damage to the soil of agricultural areas. For this reason Japan still has a forest reserve of 5·2 million acres, an area almost as large as that given over to cultivation.

Fertilizers are used on a large scale, and in the most varied combinations. Natural manures have been in use since primitive times. The farmers also employ all sorts of vegetable residues to enrich the soil: cereal straw and the leaves of leguminous plants, ashes from the kitchen and, in keeping with the old Chinese custom, human waste itself. More modern methods involve fertilization with soy bean cakes, which are extremely rich in nitrogenous materials, and with ground residues of cotton-seed hulls, corn stalks, coco- and pig-nuts. The extreme importance attached by the Japanese to the fertilization of their soils is shown by the fact that a significantly large part of the product of their fishing industry is sacrificed to the manufacture of fish meal for fertilizer. According to F. Ruellan, 45 per cent of the proceeds of the fishing industry, or about 500,000 tons of fresh fish go into fish manures every year.

There is no doubt that these technical advances, in combination with parallel improvements in transportation, distribution, and internal commerce, put an end to the famines that periodically decimated the population and left the survivors with life-long signs of physical degeneration. But there was almost no change in the chronic hunger of the people. The increase in production did not permit an increase in individual consumption, nor did it provide a more varied diet. Nothing was done to relieve the specific nutritional deficiencies, particularly the protein deficiency. To a certain extent, in fact, this desperate but controlled race to increase production, by doing away with certain sources of food supply, made the national diet more monotonous than ever. Great quantities of vegetable proteins from soy beans, and animal proteins from fish, were sacrificed to fertilize the soil and produce more rice.

How can one explain the fact that the technique imported from the West and applied with such enthusiasm and discipline did not abolish starvation in Japan? Unfortunately, along with the techniques, the Japanese imported new problems that only served to make life more difficult. While Japan was absorbing this miraculous technique, which momentarily took the sharp edge off her hunger, she was finding out that to survive in this world, a country must do more than simply increase her food production enough to satisfy her own needs. She must also become sufficiently strong to resist the economic greed of rival countries. The lesson of China—divided up among foreign interests and forcibly prevented from achieving national unity and economic independence—served as an example to Japan. She realized very early that she must be ready to fight to keep from becoming a colony of the western powers, and that her first need was to develop her human potential to the maximum. She too must become a power.

Whereupon the population policy of Japan was reversed. Severe laws were passed against abortion and infanticide. The birth rate rose sharply. (The increase from 25 per cent in 1872 to 34 per cent in 1926, a rise unique in history, can only be explained by the starvation régime to which the industrial populations were subjected during this period of imperialist industrial expansion.) At the same time the death rate fell as a result of the elimination of the great plagues of feudal times—the civil wars, famines and epidemics. The Japanese population began to increase at an astonishing rate, as the following table, based on Cressey's figures, shows:

Year	*Inhabitants*
1875	34,000,000
1900	43,000,000
1915	52,000,000
1943	64,000,000
1945	78,000,000

Thus the iron circle of hunger, which seemed for a while to be loosening, closed about the nation more tightly than ever. With this tremendous human pressure on the soil, represented by the world's highest density of population in relation to cultivated area (more than 1,000 per square kilometre), Japan, even after every possible expansion of area and improvement in technique, was unable to support herself by agriculture alone. That is the reason why Japan, from the beginning of her modern period, has thrown herself unreservedly into large-scale industrialization. It was the only way to make use of her human potential, and to feed her growing population.

Japanese industrialization came up against serious obstacles, particularly the lack of fuel and the domestic shortages of raw materials. The fact is, as Trewartha insists, that, "nature did not cut the resource pattern of Japan on a scale befitting a great power". In the face of these heavy handicaps, and hampered by her late arrival on the scene, how was Japan to compete successfully and find a market for her products, so that she could increase and stabilize her production?

The first thing necessary was a control of industrial policy that would guarantee a rigorous economic balance. Consequently, the incipient Japanese capitalism diverged right at the start from western capitalism; it did not establish absolute control by interested individuals or groups, but became a capitalism directed and co-ordinated by the Imperial Power. By means of this controlled capitalism, Japan attained such a degree of efficiency that the western peoples, amazed at the prodigious capacity for expansion of her industry and commerce, sent technical delegations to study her organizational methods. These missions came to the unanimous conclusion that the secret of Japan's success in competition for the world's markets lay in the fact that she had available, in unlimited quantities and at a negligible cost, one of the most necessary raw materials—that is, the human crop from which Japanese industry got its workers. The cheap labour provided by a constant increase in population furnished the basis for Japan's great economic expansion.

In order to meet foreign competition, Japanese industry had to set up a labour system that was little short of slavery, and that resembled the semi-slavery of feudal times. Factory workers were housed in ill-constructed barracks, and fed hardly more than a handful of inferior rice. Thus hunger was responsible for the slavery of the Japanese people, while this slavery became in turn the solid foundation of Japanese industry. This is the thesis William Brown offers in his famous book announcing the "yellow peril".

The western nations outdid themselves in furnishing the necessary tools. And in these most modern factories in the world, fitted out with machinery representing the last word in German, English, and American inventive genius, worked men and women still bound by feudal relations and by the traditional unquestioning obedience to their ancient masters—the *daimyos* and medieval barons. But the *daimyos* of the industrial era are the monopoly capitalists who make up the financial oligarchy of the country, the controlling figures of Japanese super-capitalism, organized in great cartels that include almost all the economic activities of the nation. A handful of these oligarchies, literally super-trusts, control the whole economic life of Japan, and put into effect the great national plans for industrialization. Their names have become familiar throughout the world: Mitsui, Mitsubishi, Sumimoto, Yasuka, and Furukawa.

These are the "big five" of Japanese industry. Let us look at the various activities of one of them, the Mitsubishi for example, in order to see how such groups exercise absolute control over the country's business. The activities of this trust include coal, iron, steel, shipyards, airplane and automobile factories, oil, aluminium, electrical goods, chemicals, textiles, sugar, flour, and ocean shipping. In some of these fields, E. M. Hadley asserts, this organization accounts for one-third to one-half of the entire national production. This example makes it abundantly clear that the Japanese combines have relatively more economic power than the largest American trusts.

In order to protect their capitalist interests, these new *daimyos* attempt to perpetuate the starvation and unemployment that furnish them with a cheap and abundant labour supply. In big industry, about 70 per cent of the workers are women, subject to the most tyrannical working conditions. It must not be forgotten that in this country that has just emerged from feudalism, women have no rights. As William Brown very well said, a woman is "the slave of a slave".

Thus that industry which was prescribed by the western advisers, interested in selling their machines, as a panacea to save the people from the siege of hunger, preserved or even increased the existing starvation, and created a new class of chronic starvelings—the industrial workers. As an example of how the lack of adequate nourishment affects the workers' mortality rate, Tadasu Saiki has recorded the following eloquent figures on a definitive experiment carried out by the Imperial Institute of Nutrition in Tokyo. In a factory of that city where the death rate from tuberculosis was extremely high, the introduction of an adequate diet reduced the incidence of this disease some 78 per cent.

The effect of this outburst of industrialization on the country's agrarian economy was also bad. Controlled capitalism, supported and protected by the state, followed a policy of assistance to industry by setting up tremendous taxes on agricultural production. Until the Sino-Japanese War, the peasant paid three times as much in taxes as the city dweller. It is true that the government gave the peasant technical aid and taught him the best methods of fertilization and irrigation, but it never gave him enough financial assistance. The industrialists fixed the prices of fertilizer and farm machinery as high as possible, while holding the price of farm products down to a point just high enough to keep the country's agriculture from going bankrupt.

The country's ruling financial clique—the *zaibatsu*—treat the rural population in accordance with the old Japanese saying that "farmers should neither live nor die". The farmer could not raise his living standard by increasing production, because of progressive increases in taxes, rent, and the cost of agricultural machinery.

A good example of the cold inhumanity with which this industrial economy looked upon the Japanese farmer is the case of the ruin of the natural silk industry following the 1929 crack-up in the United States. Up till then the greater part of Japanese natural silk production was absorbed by the United States, and about a million and a half Japanese families had a chance to improve their living standards by raising silk-worms. But financial breakdown came, a poverty-stricken world could no longer afford to use large quantities of silk; economical artificial silk appeared on the world market, and Japan was forced to stand by and see her silk industry ruined.

Immediately, however, the state reacted. The raising of silk-worms was thrown overboard along with the looms, and an artificial silk industry set up—even though this gave employment to no more than 200,000 families. More than a million families were sacrificed—but it was considered the only way to save this important branch of the national economy. A great many people died of hunger as a result of this desperate manœuvre, but in a few years Japan became the world's number-one producer of artificial silk.

So the fact remains that in spite of the rationalization of agricultural technique, and in spite of large-scale industrialization, starvation continues in Japan just as before. Possibly the progressive development of industry, based upon stable markets for its products and sufficient raw materials for its factories, may be able to raise the standard of living of the Japanese and put an end to the régime of hunger. But this stage has not as yet been reached.

When the industrial powers of the West woke up to the fact that Japan was flooding the world with a torrent of cheap and shoddy merchandise at prices with which it was impossible to compete, they reacted at once. The customs barriers that they erected dealt a death blow to Japan's industrial and economic structure. And it must be said that Japan had at first tried to achieve an economic and social equilibrium by pacific means, through simple commercial manœuvres. The following words are those of William Vogt: "In all fairness to Japan it should be recognized that for decades she made vigorous efforts to secure more raw material and food by purely economic means. These were denied her, finally largely through American tariffs. We were eager to sell to Japan but quite unwilling to buy her coolie-made goods."

9

In spite of Japan's vigorous industrialization, its farm population was still 50 per cent of the total as late as 1930, and 40 per cent as late as 1945. The misery in which the agricultural population was forced to live furnished the principal driving force of Japanese aggression. This depressed rural population made up the bulk of the Japanese army, which interpreted popular sentiment and represented a search for better living conditions for the people. It was a search for social justice, even though the method was force, military conquest, and expansion.

For many years, two distinct political tendencies struggled for supremacy in Japan. They were both nationalist and imperialist, but they preached different means to the same end. The party directed by the leaders of industry advocated simple economic expansion, without wars of conquest; the militarists, on the other hand, called for a solution to the economic problem by force of arms. The industrialists opposed open conquest because they feared the inevitable complications with the western powers, with whom they had reached a certain diplomatic understanding through their interests in the great international cartels. This anti-war party also feared that the conquest of new territories would relieve population pressure in Japan and create new opportunities for the surplus population, thus forcing wages up and reducing industrial profits.

For these reasons, the political groups controlled by the Mitsui and Mitsubishi called simply for an extension of the sphere of Japanese economic influence over foreign territory, and their expansionist policy was disguised as a programme of fraternal co-operation with the other countries of Asia. Taking advantage of the hostility felt by Asiatic peoples toward western colonial exploitation, Japan coined the celebrated phrase, "the Greater Eastern-Asia Co-prosperity Sphere".

This policy was unsuccessful, primarily because the other nations of Asia did not trust Japan. She had a way of showing her claws from time to time in predatory raids on neighbouring countries. In the second place, the western powers opposed any such unification of interests as altogether too favourable to their formidable Oriental rival. In the face of this breakdown, and of the continued hunger and misery goading the Japanese people, the pro-war expansionists began to gain the upper hand in national politics. The influence of the army grew stronger and stronger, until the militarists were able to drag the country into the adventure with China, and then into the great war against her two-century-old enemies, England and the United States.

In order to carry out these dangerous adventures, the Japanese militarists saturated the country with propaganda to the effect that the farmer's hunger and the city worker's extreme poverty—all the miseries of the nation—were exclusively the result of the white man's undying hatred of the Japanese. It was the white man's hatred that would not let Japan get her head above water, that refused her raw materials for her industry, that denied her markets for her products, and even prohibited her from relieving the congestion of her lands by emigration.

Japanese hatred and desire for revenge flourished in conditions of hunger as if in a culture medium, and helped greatly in building up a stubborn and fanatical army. The prevailing mood was that the western powers hated Japan and wanted to keep her in hunger and misery, and the army was justified in undertaking the violent conquest of national liberation. In her desperation to break out of the iron circle of hunger, Japan adopted the barbarous methods of aggressive imperialism and threw overboard all respect for the rights of others. When she succeeded, with her first impetus, in humiliating the great powers of the West, she felt that she had merely got even for a long and systematic persecution. Analysing those terrible war years, when Japanese fascism, expelling the western overlords, won control of a great part of Asia, Frederick Schuman writes as follows: "That the youngest of the great powers should have taken the initiative in bringing the oldest of the great powers to the brink of ruin was perhaps the penalty which age must ever pay to youth when age teaches youth not virtue but vice."

The peoples of the West must bear a large part of the blame for the fact that Japan fell into the hands of fascists and militarists, and for the fact that by following the sickly star of aggressive imperialism she brought about the terrible evils of the war in the Far East. The error was not a question of race hatred, for that is something that really does not exist. The people of the West never exhibited a national sentiment of hatred for the Japanese or for any other people. In moments of suffering, on the contrary, Japan's sorrows always found a sympathetic echo in western hearts. After the 1923 earthquake, which almost levelled Japan, the people of the United States hastened to organize an extensive relief campaign, and sent enormous aid to the devastated country.

The sin of the western peoples lay in letting interested imperialist groups block the just aspirations of the Japanese people for a better life, and in letting the Japanese capitalists preserve a régime of medieval semi-slavery in a country that was, in terms of technical development, westernized. If it had been possible for Japan to stabilize her industry by selling her products to the same areas of the East from which she got her raw materials, and if the Japanese government had been forced to establish more humane living conditions for her peasants and factory workers, the birth rate would have fallen just as it fell in the 1920's, after the years of prosperity that the First World War brought to Japan. And with internal economic equilibrium the aggressive sentiments would have cooled off, and the war propaganda expressed in documents like the memorable writings of General Araki and the famous Tanaka memorial would no longer have found an echo in public opinion.

But nothing, or almost nothing, was done in this direction. If anyone spoke of the misery of the Japanese people, or of the chronic state of famine in which they lived, the leaders of the West replied that these people were not like other human beings. They had abnormal powers of resistance to suffering, and had no objection to going hungry. But the hunger of the Japanese people, which seemed so remote and unimportant to the West, built up a permanent spirit of revolt, and led the Japanese into one of the greatest blood baths of history, which was only staunched by recourse to atomic terror.

Imperialism, however, brought no improvement in Japanese living conditions, either. When war was declared on China in 1937, the Japanese government took energetic measures to improve the nation's food supply by stimulating agriculture. They arranged for subsidies to farmers, for crop insurance, and special courts for agricultural disputes. These measures had little effect, and beginning with the attack on Pearl Harbour in December, 1941, food production, instead of increasing, suffered a decline. It is true that the occupation of extensive new territories brought new food resources under Japanese control, but many of these lands were devastated to the point where it became a problem to feed the local inhabitants. The food needs of an ever-expanding army did not permit a liberal ration for the civilian population; and as the war went on and Japan suffered mounting reverses, the situation grew progressively worse. When Japan sued for peace, the average ration of the civil population was about 1,000 calories per person per day—absolutely a famine régime.

In an investigation carried out just after the end of the war, the Medical Division of the Bombing Survey revealed that in Kyoto, a city that had not even been bombed, the whole adult civilian population had lost an average of 10 pounds apiece, while 65 per cent of the population had lost 20 pounds. When Konoye advised the Emperor Hirohito to surrender, he suggested, according to J. B. Cohen, that a communist revolution might result from the desperate living conditions of the Japanese people.

When they set up their military occupation of Japanese territory, the Allied powers faced a grave problem of food supply in a country of more than 70,000,000 inhabitants with its food stocks practically exhausted. A careful study of the problem made it immediately clear that the situation was really serious at the moment, and that it would certainly be worse the following year. They foresaw that the spring of 1946 would bring an acute food crisis, and that the famine would be accompanied by inflation and, consequently, social unrest. The Supreme Command of the Allied Powers (SCAP), in order to meet this crisis and its unpredictable consequences, immediately put an emergency plan into effect, which included food rationing, the urgent importation of certain basic foods, and control of distribution.

Along with this emergency plan, a long-range plan was put into operation, based on a reconstruction of the national economy along democratic lines. Basic to this plan were agrarian reform and a new industrial policy. In the field of agriculture, the SCAP acted with great foresight, and obtained relatively promising results. Under its auspices the Japanese government passed the law of October 21, 1946, calling for the transfer of the ownership of land to those who actually cultivate it. In order to carry out this measure, the government was to buy up 70 to 80 per cent of the land cultivated by tenants, and resell it to them. The tenants were to pay for it over a period of twenty-four years by means of annual instalments proportional to, and never more than a third of, their farm income. This project in agrarian economy on a grand scale was to involve about 2,000,000 hectares, or roughly a third of the nation's cultivated area. The plan was efficiently executed; three years after the occupation the government had already acquired about 1,600,000 hectares, that is, 80 per cent of the lands to be distributed.

Measures to stimulate the farm co-operative movement were put into effect by legislative decree, and this too gave a certain impetus to agriculture, with the result that food production in Japan proper has come back to pre-war levels. But the loss of other sources of supply—Formosa, Korea, and Manchuria—which formerly contributed a quarter of the home islands' needs, has resulted in a tremendous dietary deficit. Two years after the beginning of the Allied occupation, the daily individual ration had been increased to only 1,240 calories, in contrast with the minimum diet necessary for health of 2,160 calories. On this basis, the estimated deficit for 1950 will be 4,000,000 metric tons of rice, that is, 24 per cent of the Japanese people's total needs.

Undoubtedly, the food problem has been greatly aggravated, and the benefits of increased production cancelled out by the tremendous increase in population that has taken place during the years of the Allied occupation. A SCAP report of 1949 states that from 1945 to September, 1949, the population of Japan proper increased by about 10,000,000, reaching the total figure of 82,500,000 inhabitants. This terrific population increase resulted, in part, from the repatriation of some 5,000,000 Japanese who were scattered in various overseas areas at the end of the war. The balance, about 5,100,000, was an extraordinary natural increase resulting from the excess of births over deaths. This natural increase of 5,000,000 individuals in four years has no precedent in the demographic history of Japan, and can only be explained as the surge of biological recuperation that always occurs in the vital history of societies following the shocks and losses of war, famine, or pestilence. In the various five-year census periods between 1920 and 1945, the increase of Japanese population, according to Buchanan, was 3·6, 4·4, 4·6, 4·1, and 3·9 million persons respectively. The figure of 5,000,000, registered in the post-war period 1945–49, never once was reached, and I take this as a confirmation of my theory that hunger is a factor in regional overpopulation.

With such a volume of population, it was patently impossible to raise Japanese dietary standards by stimulating agricultural production alone. A SCAP report made it perfectly clear that food and raw materials sufficient to meet Japan's needs could only be obtained through foreign trade. Any hope of a solution, therefore, lay in recuperation of the country's industry, which would then serve as a basis for commerce abroad. Up to now, unfortunately, this industrial recovery has not been satisfactory. The intervention of the United States in this field has not been nearly so happy as in the field of agricultural activity. The principal point of SCAP industrial policy was the destruction of the great combines and the liquidation of the gigantic trusts that had monopolized Japanese industry. Under the inspiration of this policy, the Japanese government passed special legislation aimed at "elimination of excessive concentration of economic power". This legislation, which proposed a house-cleaning of the national economy, was opposed head-on by the tremendous underground forces of the interests it sought to control, and it never succeeded in breaking the power of the *zaibatsu*, the old financial oligarchy of Japan.

Although industry was cut loose from its totalitarian relationships, it was never reorganized on any other basis. The Allied intervention succeeded in demolishing the monstrous totalitarian economy that had kept the country in misery, but it was incapable of setting up any other type of industrial economy in its place. It is for this reason that Japanese theorists state that the new industrial policy inspired by the Americans, by completely destroying the leadership, the best brains and the technicians of the Japanese industrial organization, has put an end to its creative potentialities. These apologists of the *zaibatsu* call the new economic policy one of "atomizing" Japanese industry, implying that Japanese industry was annihilated by a force as destructive as the atomic bomb.

And industry does, in fact, show little sign of recovery. It has not yet reached 40 per cent of the pre-war level, and the effects of industrial stagnation are disastrous for the economic equilibrium of the nation. One result is that Japanese foreign trade has not got back to 30 per cent of its 1930–34 level. About 90 per cent of Japanese imports come from the United States, but the United States takes in return only about 10 per cent of Japan's exports. Another result of the breakdown of Allied industrial policy is the terrible inflation, which has brought about shocking increases in the cost of living. During the first two years of Allied occupation, the cost of living in Tokyo rose (according to the *Times Review of Industry*) 2,000 per cent and food prices reached a point 65 times higher than in 1937. This serious economic situation keeps the Japanese people in a state of chronic undernourishment and misery, and constitutes a critical impasse for the Allies. According to certain Americans, the United States is feeding Japan out of charity, and this can't go on indefinitely. In the words of Vogt, "Japan is now being fed, and miserably fed, through American charity". The American bankers and financiers have begun to get nervous about the situation, and have already made it clear through one of their spokesmen—the Detroit banker, Joseph Dodge—that this "fantastic

Oriental opium dream, for which the American taxpayer is paying, should end by the latest in 1951".

Another opinion has it that the United States is sabotaging Japanese industrial recovery through fear of competition, and is sacrificing the living standards of the Japanese people as well as the world's social and economic peace. The problem is too complex and difficult for a hasty judgment. Only the future development of the world scene can show who is right.

The economy of Japan, ruined and oppressed, will never recover until it can be integrated with the rest of Far Eastern industry, but at the moment this seems difficult indeed. What is necessary, as Jerome B. Cohen correctly emphasizes, is to "wait upon the cooling of the boiling, turbulent cauldron that is presently Asia".

There is one fact, meanwhile, that cannot be denied: implacable circumstances have continued to keep the Japanese people in a state of undernourishment and hunger.

CHAPTER V

HUNGER IN THE DARK CONTINENT

One of the world's oldest authentic documents on hunger is the "Stele of Famine", which was found over a granite tomb at the first cataract of the Nile. This famous gravestone is inscribed with the report of a terrible famine that ravaged Egypt during the reign of Tosorthrus, some 2,000 years before the time of Abraham. The king's own lamentations have been preserved for us in hieroglyphics which read, according to Ralph Graves, as follows:

"I am mourning on my high throne," said this monarch of ancient times, "for the vast misfortune, because the Nile flood in my time has not come for seven years. Light is the grain; there is lack of crops and of all kinds of food. Each man has become a thief to his neighbour. They desire to hasten and cannot walk. The child cries, and the youth creeps along, and the old man; their souls are bowed down, their legs are bent together and drag along the ground, and their hands rest in their bosoms. The counsel of the great ones of the court is but emptiness. Torn open are the chests of provisions, but instead of contents there is air. Everything is exhausted."

Documentary evidence as to incursions of famine in the African continent has been accumulating since remote antiquity. And famine remains in power there to this day, ruling the destinies of the African peoples in one form or another. Sometimes it is the pitiless yoke of starvation, periodically taking possession of the semi-arid steppe lands of the north in the manner that Jacques Nouvel has described, and at others it is chronic hunger permanently oppressing the populations of the equatorial forest and tropical savanna. Among the continents, only Asia has provided an equally broad stage for the drama of universal hunger.

No corner or scrap of land in Africa has escaped hunger. This is a continent of the starving, all of it. And in hunger and chronic malnutrition may be found one of the most decisive reasons for the backwardness of Africa, for the relative stagnation and lassitude of the greater part of its peoples.

I

Africa is the second largest continent in the world, and one of the least heavily populated. Within 11,500,000 square miles (four times the area of the United States) live only 180,000,000 people. Yet with this vast territory, making up the most compact of the continents, at its disposal, the scant population has been unable to escape the siege of hunger.

As happens in other hungry lands, there is in Africa a whole series of factors conspiring against the liberation of man from the pressure of his anguished search for food. Some are natural factors, resulting from the geographical conditions of the continent itself. Others are cultural, inseparable from the economic conditions of life of the African populations, most of whom are subject to the pressure of European colonialism.

Nobody can say that Africa as a whole is the promised land, flowing with milk and honey like the land of Canaan. Far from it. At first sight the continent seems well adapted to human habitation, situated as it is between Europe and Asia, in the centre of the world's great land mass. It possesses great expanses of level lands, a large part of them watered by the greatest rivers in the world—the Nile, the Congo, the Niger, the Zambesi—and it has great mineral wealth and a high potential hydraulic power. But these advantages are offset by other features extremely unfavourable to man in his struggle with his environment.

Africa, with practically the whole of its great triangle of land falling within the torrid zone, is the most tropical of the continents. The African climate is, of course, not an absolute barrier to human occupation, especially with modern technical methods that permit the effective adjustment of man to tropical climates, but nevertheless it is a serious obstacle. The difficulty is not so much the direct action of the climate, asphyxiating and annihilating human beings, as the hasty generalizations of certain followers of climatic theories of civilization would have it. Rather, it is an indirect effect of the types of soil and vegetation that such climates produce. More than half of the African continent is made up of two kinds of country quite unfavourable to human habitation—tropical desert and equatorial jungle.

The outstanding trait of the physical geography of Africa is a broad band of desert extending from 15° to 30° north latitude, and stretching more than a thousand miles from the Atlantic to the Red Sea. This is the Sahara, the great desert, which divides the continent into two distinct cultural worlds—White or Mediterranean Africa, and Black or Equatorial Africa. In the desert, the great obstacle to the production of food is a permanent shortage of water. In the jungle, it is the relative poverty of the soil. As we have seen with reference to Latin America, equatorial soils are generally poor, and are rapidly exhausted when submitted to continuous cultivation. On the savannas and steppes, which are transition zones between forest and desert, the soil is somewhat better, but the irregular and unpredictable rainfall is a serious hazard to productive agriculture. There remain only a few fertile and well-watered spots—oases—where production is undeniably high.

That is the somewhat deceptive picture of the physical geography of the dark continent which led Vogt to make the extreme statement: "Nearly all of Africa is marginal for agriculture." I would not go so far. As I shall point out later, a great deal of African land has proved suitable for the cultivation of many different plants. But such cultivation depends upon special measures, without which it is doomed to failure.

Africa's unfavourable natural factors could have been overcome or at least minimized by rational human conduct. Adequate technical methods could have been supplemented by the experience of natives who have lived there since prehistoric times. But on the contrary, Africa's difficulties were greatly aggravated by the ill-conceived practices of European settlers. This continent was one of the greatest hunting grounds for colonial piracy, which committed all its usual exaggerations, illegalities, and crimes against defenceless populations. Even today, with the exception of two or three groups that have obtained charters of political independence, all Africa is politically and economically controlled by European powers in whose colonial policies there is indeed little to praise. George T. Renner is right in saying that, "as a consequence, Africa is today a vast study in imperialism".

The negative effect of European colonization on natural food resources made itself felt through the whole series of social and economic pressures which constitute the very essence of colonial exploitation in all ages. The first of these was that mercantilism which, motivated by greed for quick and easy profits, has been the moving force of colonial adventure since earliest times. The colonist concentrates all his attention on easy profit, with complete indifference to the economic balance of the regions to be exploited. Ever since the days of Rome, when the Empire expanded into all Africa north of the Sahara and forced the region into a Mediterranean type of culture, the technique of colonization has practically always been one of systematic looting of natural riches. *Delenda est Carthago* is a good symbol, a watchword that expresses the European conqueror's code of conduct toward the peoples of other continents.

The Romans found fine fields of cereals and great olive orchards planted on the slopes of the Atlas Mountains and in the coastal valleys along the Mediterranean, but in a short time they transformed the region into desolate steppes and desert. The soil was overworked to produce the grain demanded by the mother country, and the Atlas forests were destroyed to supply wood for the Caesars' armadas and luxurious trimmings for Roman palaces. The result was the rapid downfall of Roman colonies in the north of Africa. It is true that the Romans built great aqueducts, dams and pompous cities in North Africa. But with the economic decadence of the region all this came tumbling down and was covered by the sand of the desert, which began to advance across a landscape denuded of its original coat of natural vegetation.

As an example of the destructive fury with which Europeans treat colonial wealth, Gautier cites the case of the disappearance of elephants from the Atlas Mountains during the Roman occupation. It was here that Rome procured the elephants for her army, but by the end of the Empire all the pachyderms were gone, "annihilated by the demands of the Roman ivory trade, and by the destructive fury characteristic of the European throughout the ages".

Modern colonization in Africa also began under the flag of mercantilism. The first Europeans to reach the west coast of the dark continent in the fifteenth century had no other thought than profitable trade—how most easily to get hold of merchandise that could be negotiated for good prices in the various European countries. The Portuguese, pioneers of colonial expansion in the modern world, were soon to prove themselves the most capable of all peoples in putting down colonial roots in the tropics. But at first they merely established trading posts along the coasts for their overseas commerce, and took no interest in occupying African territory. Here there comes into the story a geographical factor that cannot be ignored—the natural resistance of the African coast to penetration. A shore line largely lacking in natural ports, and a continental tableland rising abruptly from the shore and difficult to scale, make Africa the most impenetrable of the continents. It is even difficult to ascend the rivers, because successive falls and rapids make them unnavigable from the mouth upward.

Whether on account of this geographic barrier, or because of the dominant spirit of the epoch, the Portuguese, and after them the Spanish, French, English, and other peoples interested in economic expansion on other continents, were not concerned with Africa except as a supplier of merchandise. It soon became clear that the most profitable merchandise was the Negro himself, to be sold as a slave in other colonial countries. Consequently, the slave trade was established, which, according to Grenfell Price, was the principle cause of the failure of English colonization in the Antilles, and the principal reason for the failure of all European colonization in Africa. It is clear that even today, the suspiciousness of the native, and his unwillingness to collaborate with Europeans in the development of Africa, are results of the fear and distrust which western conduct has built up in the spirit of the Negro. The greatest obstacles to England's current plans to raise the standard of living of the African population, plans in which one may sense a sincere desire to improve the economic and biological situation of the people, are the reserve, distrust and suspicion of the natives, to whom the white man has never come except with the disguised purpose of exploiting and enslaving them.

After the great European explorers of the last century opened up the continent, colonial exploitation was no longer limited to the slave trade and the purchase of ivory and spices through the coastal trading posts, but there was still no improvement in the treatment of the natives by the European colonizers. Penetrating and occupying the most fertile valleys, the whites systematically drove the Negroes before them, forcing them up the slopes and to the cultivation of soils that were rapidly exhausted by erosion.

The establishment of plantation colonies, originated by the English and afterwards imitated by the other imperialist countries, had a grossly disturbing effect on the African nutritional economy. The plantation system is based on great land holdings, or latifundia, organized for the large-scale production of cash crops. It implies the destruction of natural wealth—regional fauna and flora—as well as the suppression of local subsistence agriculture. We have already seen how this system devastated entire populations and great expanses of land on the American continent, and here I merely wish to insist on its inhuman quality, so well brought out in the words of that great student of colonial questions, Paul Leroy-Beaulieu: "The plantation colonies became regular factories, whose only purpose was the production of sugar, coffee, and other high-priced merchandise; subsistence agriculture vanished, and the land was exploited in season and out with only one product in view. There was in fact no colonial society. The absenteeism of the proprietors, the absence of a middle class, the oppression of a multitude of men who had no rights, but were considered mere tools recruited for the traffic, all these anti-social factors gave

European establishments in the tropics a sad and pitiful character, quite contrary to the generous principles of our civilization."

In Africa, as a result of excessive stripping of the soil, the harmful dislocation of workers, and the stagnation of agriculture for food production, this system was disastrous to the population of various areas. The plantation system, and later the exploitation in mines and factories, created a new social class in Africa—the proletarians, uprooted from the soil, cut off from their tribal organizations, and living, as Gilles de Petichy has pointed out, lives of intense misery. Today two societies exist side by side in Africa. There is the traditional society organized in family groups, living by primitive agriculture, stock raising, hunting and fishing, all within a certain ecological balance, and the society of agricultural and industrial wage workers, who represent the lowest nutritional level of the continent and perhaps, according to F.A.O. experts, "the lowest in the world". It is estimated that a fifth of the population of Africa has become a part of this black society on the way to proletarianization.

An idea of how European influence upset the African food economy emerges most clearly through a regional analysis, taking into account the peculiarities of each of the great divisions that make up the mosaic of the African landscape. This analysis will give separate consideration to the two Africas—White Africa, lying to the north of the Tropic of Cancer, and Black Africa, to the south.

2

White Africa, so called, includes the lowlands along the Mediterranean, the high steppes of the Atlas Mountains, and the immense Sahara Desert, where the only signs of life are the scattered oases lost in the tremendous desolation of rock and sand. This is the part of Africa, peopled by Semitic and Hamitic racial stocks, that has been longest known to the western world. Politically, it takes in Egypt, French North Africa with the colonies of Tunisia, Algeria, and Morocco, and the former Italian colony of Libya.

With the exception of Egypt, where nutritional conditions have always been precarious, this area typically affords a minimum diet which is more or less balanced, although not at all abundant. The most serious nutritional problem of the whole region is in Egypt. Although this country has 380,000 square miles of territory, it is practically all desert. The only usable land lies in the oasis of the Nile, which, including valley and delta, amounts to only 13,600 square miles. In this limited strip of fertile soil, irrigated by the Nile, are concentrated practically all of the country's estimated 19,000,000 inhabitants.

About 62 per cent of these are the *fellahin*, Nile peasants living in the most absolute dependence on the products of their irrigated fields. For innumerable centuries the *fellahin* have cultivated these lands, whose harvest was contingent on the periodic overflow of the Nile. The cultivation of cereals and other food plants in the valley of this fabulous river supported the splendour of ancient Egyptian civilization. With the vegetable products of their soil, supplemented by animal products acquired by trade with the stock-raising nomads of the neighbouring steppes, the Egyptians managed a more or less balanced diet. It is true that they suffered from the irregularity of the floods—the mysterious and omnipotent will of the divine river. The Nile often failed to overflow, and left the land thirsty and the whole region famished. According to an old Egyptian saying, "when the land is thirsty, the *fellah* is hungry". But aside from these calamitous periods of drought, and of famine, the *fellah* was reasonably well fed; he had whole-grain cereals (wheat and barley), legumes, olive oil and fruits.

English intervention in the economy of Egypt upset this precarious balance. Today, with the Nile harnessed by western technique, the *fellah* has been freed from his periodic famines, but is in exchange condemned to a régime of chronic hunger. His diet is not only insufficient and monotonous, but deficient in many nutritive essentials. The construction of the famous Aswan dam in 1902 put an end to the dependence of the *fellah* on the floods of the Nile, but marked the beginning of his dependence on a complex of British commercial interests that were to alter his way of life completely. The replacing of flood-time irrigation by year-round irrigation led to sharp reduction in the fertility of the soil, which ceased to receive the precious gift of mud, carried down periodically from the heart of Africa to revitalize the age-old farm lands of Egypt. The year-round cultivation made possible by the new irrigation methods also helped to hasten the progressive exhaustion of the soil.

The proletarianization of the rural population, combined with the elimination of famines and the beginning of chronic starvation, soon produced the amazing population growth that has been registered in this first half of the twentieth century—from 8 to 19 million inhabitants. Such a growth of population in so limited an area has tremendously increased the demographic pressure on the soil, which has reached an extreme limit of almost 2,000 individuals per square mile of cultivated land. Moreover, a large part of the irrigated land was reserved to produce cash export crops of interest to the British Empire—particularly cotton and sugar—which further aggravated the nutritional poverty of the *fellah*. "In such an overpopulated country, the reduction of food crops in the interest of industrial crops becomes a real danger," says E. F. Gaitier, one of the best-informed students of this region of Africa.

The *fellah* today has no food surplus available for exchange with other zones, and must satisfy all his biological necessities with a little wheat or rice alone. These he cultivates on tiny scraps of land which average only 5 feddan (1 feddan is equal to 1·038 acres). Such a situation leads to an extremely indequate diet; the most serious deficiency is the small amount of animal proteins—about 12 grams a day. Vitamin deficiencies also must necessarily be general in this area, as is demonstrated by the high pellagra rate. This disease, as we know today, results from many different deficiencies and is characterized by many different symptoms.

The alimentation of the North African Berber population is much more varied and better balanced. It is made up of cereals—hard wheat, barley, and sorghum in the form of *galetas* or *cuscuz*—olive oil, milk, cheese, dates and figs. Meat consumption is very low, but the use of goat, sheep, and camel milk answers perfectly well the needs of the organism for high-grade animal proteins. Europeans have long been intrigued by the excellent physiques and remarkable resistance of these people. This is particularly true of the nomads who live along the edges of the desert, Berber peoples of characteristic Bedouin type whom Paul Harrison described as, "the lean, indefatigable nomad, with the eyes of a falcon, but proud, hungry and indescribably dirty".

The Arabs succeeded the Romans in this region, and by overgrazing the land contributed greatly to the decline of native vegetation. But although this region has suffered the destructive impact of various civilizations, it retains, even today, a good reserve of sheep and goats which helps to hold up the quality of the regional diet. Unfortunately, the great drawback of the region is the inconstancy of its climate. Rainfall is extremely irregular, and the traditional Mediterranean type of diet, frugal and healthy, cannot always be maintained.

The food intake of this pastoral and agricultural people depends absolutely on the amount of rainfall. North Africa is the typical land of Biblical fat and lean years—times of plenty and times of need. Whenever the rains fail or grow scarce, most of the fields wilt, and the stock begins to die of hunger and disease. So far, it has been impossible to save the local population from the recurring famines that follow periods of drought. It is mostly the natives, subsistence farmers and stock raisers of the steppe regions, who suffer the brunt of these climatic shocks. The European population, estimated at about 2,000,000, is concentrated along the more humid coast and makes greater use of irrigation. For this reason they are better able to defend themselves, even without their additional economic advantage of superior buying power, which makes it possible for them to pay extortionate prices for imported food during difficult periods. Meanwhile the improvident native populations, saturated with Mohammedan fatalism, are forced into extreme poverty and want. They have no recourse but to sell their lands, abandon their communities and emigrate to the cities of the littoral, where they swell such terrible African slums as the notorious eastern section of Algiers, the Casbah.

Periodic famines, then, are a serious cause of social and economic disintegration in the region, leading to the progressive disappearance of small property and the growth of a rebellious and unemployed urban proletariat. Jacques Nouvel, in his interesting study of famines in Morocco, showed that the principal social victims of the catastrophe are the small farmer and cattle raiser: "When his reserves are used up, the small proprietor is forced to sell his land. The rich farmer with grain in his silo, as well as the city merchant with cash resources, hasten to buy up such land. In keeping with the ancient custom of the country, they buy on instalments, and the result is that they hardly ever finish paying the amount stipulated, or the agreed-upon quantity of grain. Or when they do pay, it is after so many delays that the grain or money have already lost their value. So it is that the 'big fellows' gobble up the crumbs, the holdings of the 'little fellows'."

This monopolizing of the land by capitalists and bankers had reached such a point that the Moroccan government, in 1945, was moved to pass a law making family property, fixed at a maximum of 5 hectares, inalienable except on express official authorization. Students of the social problem in this area, however, say that this legal provision falls far short of preventing abuses, and that through its loopholes small landholders continue to be robbed of the scraps of land that represent their only means of subsistence. This increasing movement of the land from the hands of the native into those of the European explains why in Algeria, although of her 7,000,000 inhabitants only 1,000,000 are Europeans, a third of the cultivated area (about 5,000,000 hectares) belongs to the latter.

3

From the southern edge of the Sahara to the Cape of Good Hope extends so-called Black Africa, where the Negroid populations of the continent vegetate. There are the Negroes proper, Sudanese and Bantu, and the Negrillos, the Hottentots and the Bushmen. In this immense area, covered by the most varied types of vegetation, as against a native population of more than 100,000,000 there are only 3,000,000 Europeans, two-thirds of whom are concentrated in the subtropical territory of the Union of South Africa. In the humid [illegible] equatorial belt, which constitutes the real heartland of [illegible] the white man is a rarity, an exotic touch in the primitive landscape. Even in the cities—created by the white man[illegible]ents.

representative of his western culture—the majority of the population is Negro rather than European. Leopoldville in the Belgian Congo has 5,000 whites as compared to 114,000 Negroes; and Brazzaville in the French Congo has some 2,250 whites as against a native population of more than 50,000.

The Europeans never attempted real colonization here; they never undertook to put down roots and populate these areas. They merely set up a skeleton administration designed to exploit the productive capacity of native labour. A handful of colonists lost in the immensity of the jungle handles all the administrative work of the colonial enterprises.

The nutritional situation in Black Africa varies enormously in the different geographic regions, in keeping with the natural resources of each zone and the life of the people in relation to them. To facilitate our study, we can distinguish the following great natural regions of equatorial Africa: the tropical rain forest, the savanna region, the semi-arid steppes, the desert, and, finally, the subtropical regions of the South African plateau.

The broad belt of tropical rain forest extends on both sides of the equator. Next to the Amazon basin, it is the largest, thickest, and most impenetrable mass of vegetation in the world. It covers some 900,000 square miles, and half of it lies in the enormous basin of the Congo. Two sharply distinct racial groups live there: the Negrillos, and the Bantu Negroes. The Negrillos, living in complete cultural isolation, occupy the practically impenetrable depths of the jungle between 6° north and 6° south latitude. Their economic régime, limited to hunting, fishing in the rivers and lakes, and gathering wild plants, is completely primitive. As a result of the lack of organized agriculture, their alimentation is extremely precarious. It is both insufficient and incomplete—quantitatively deficient in calories, and qualitatively lacking in proteins, mineral salts and vitamins. Hunting and fishing alone do not provide these groups with nearly enough animal proteins; and as fruits are not so abundant in the equatorial forest as might be supposed, the supply of vitamins also leaves much to be desired. So it is no wonder that this human group shows the anthropological characteristics of extreme malnutrition. They are pigmies; their height varies between 51 and 57 inches, and they show marked prognathism, achondroplasia, and other deformations of the bones.

So far as the Negroes proper are concerned, two separate situations must be considered. On the one hand there are the populations who live in their natural surroundings, scattered through the forest or grouped together in native villages, and on the other the populations influenced by contact with the Europeans. These make up the ro proletariat, who live in towns and draw wages from the white Of the two groups, the better fed is certainly the primitive

Negro society, which still keeps up its tribal organization and its original tradition of diversified farming.

By burning over small areas in the midst of the forest, the Negroes open clearings and set up their subsistence agriculture. This means principally the cultivation of manioc or cassava, bananas and plantains, potatoes and yams, supplemented by cereals such as corn, millet, sorghum and rice. On the basis of these crops, plus certain oleaginous fruits and other products of the forest, the Negro organizes his predominantly vegetarian diet. The staple food of this diet is manioc, which is grown on more than half of the land cultivated. The diet may not be overly abundant, but qualitatively it is a long way from any specific defects that might lead to true states of deficiency. It is true that cattle are not raised in this area, both on account of the absence of pastures and because of serious regional infestation by insects that transmit epizoötic diseases, particularly trypanosomes, and this suggests an inadequate supply of good proteins. But the Negro does what he can to make up for this shortage by turning to the virgin forest, where he hunts and eats everything indiscriminately, from hippopotamus and crocodile to rats, snakes, locusts and ants. Although manioc, consumed as flour, is extremely short in vitamins and salts, this is not true when the African Negro uses it as a raw salad, eating the tender shoots of the plant along with the tubers. And good supplies of vitamins are furnished by sauces prepared from jungle plants, and by the palm oil that plays such a large part in the nutrition of this area.

This primitive economy, because it tends to exhaust the soils that are used, comes nowhere near guaranteeing a regular and adequate supply of food, year in and year out. But as the forest is immense, and the population reaches no great demographic density, this precarious equilibrium held up satisfactorily until it was upset by the coming of the white colonist. In fact, investigators who have studied the nutritional conditions of these primitive groups are unanimous in stating that they show no clinical signs of dietary deficiency. One of the most striking indications of the superiority of this primitive diet is the magnificent condition of the teeth of these native populations. Dr. Weston A. Price, for example, reported that among six tribes using the primitive diet in Kenya, he could not find a single case of tooth decay, nor a single deformation of the dental arch. In many other tribes too, this investigator observed an almost complete absence of caries. Among thirteen primitive tribes studied, he found not a single irregularity in the position of the teeth. But when these same tribes were transplanted and put on a civilized diet, their teeth began to decay at once.

Bigwood and Trolli, who studied food conditions in the Belgian Congo, came to the conclusion that although the diet was deficient in energy materials, it showed no deficit of protective elements.

They attributed this to the use of "fruits and green vegetables, which seem more familiar to the average inhabitant of the Congo than they do in European countries". And they went on to say that, "other typically colonial foods, apparently rich in protective elements, are no doubt also effective in defending the Negro against symptoms of deficiencies. Such is the case with edible insects, from which it follows that it is wise not to try to change these food customs, which have been confirmed by favourable natural selection."

Unfortunately, contact with the Europeans brought a change in these primitive customs which had serious consequences for the health of the natives. The first European innovation which worked to upset native food customs was the large-scale production of cash crops for export, such as cacao, coffee, sugar and peanuts. We already know how the plantation system works, but this instance provides some concrete evidence of its evil effects. A good example is that of the British colony of Gambia in West Africa, where the culture of food crops for local consumption has been completely abandoned in order to concentrate on the production of peanuts. As a result of this monoculture, rice and other foods must be imported, and the nutritional situation of the colony could hardly be worse. In an inquiry carried out in this area by the Committee on Nutrition in the Colonial Empire, the experts came to the following conclusions: "In general, the diet is excessive in carbohydrate and deficient in the protective food substances, animal fat and protein, mineral salts and vitamins . . . The high infant mortality (369 per thousand), the marked prevalence of dental caries and the frequent manifestations of vitamin A and D deficiency are clear evidence of dietary inadequacy. Beriberi is comparatively rare, but mild cases of neuritis are not uncommon. A characteristic is the physical and mental lethargy of the native farmer which is undoubtedly due, in part at least, to lack of proper food."

Wherever the Negro's contact with the European was prolonged, one finds a notably deficient type of diet. In various parts of Africa, for instance, a children's disease is found, almost always fatal, known as *Kwaskiorkor*, or malignant malnutrition. This is a typical manifestation of inadequate diet, characterized by cessation of growth, oedemas, fatty diarrhoea, fatty degeneration of the liver, and sometimes bleaching of the skin and hair. Although the disease cannot be traced to any one deficiency, it certainly represents a shortage of many elements, including proteins of good quality. In the opinion of Dr. H. C. Trawell, who studied the disease for 20 years in Uganda and Kenya, this last deficiency is the prime factor.

It is not only by reducing regional food production that the money-crop system is harmful to the native. It also ruins his soils by inviting erosion. This is the case with the cacao plantations of the Gold Coast and the peanut culture of Senegal. According to Gourou, the forests of the Gold Coast are on the way to extinction, and the soils of Senegal are being destroyed in the most shocking manner. "The soils of northern Senegal, in the Louga region, are already ruined, and those of Cayor, in central Senegal, are going the same way. The damage done by peanuts, in fact, goes beyond the borders of Senegal. The fields are cultivated, in part, by seasonal agricultural workers who come from the Sudan to make a little cash money. But the result is that there are not enough hands, during the rainy season, for the work in the Sudan. The widespread culture of peanuts represents false riches, because it compromises the agricultural future of Senegal, and unbalances the economy of the Sudan."

Gourou is absolutely right in calling attention to the problem of the native worker as one of the aggravating factors in the chronic starvation of equatorial Africa. This is in fact one of the most difficult problems of colonial policy, and one that has profound meaning for the future of the African territory. Colonial land exploitation, based on cheap and abundant labour, runs into insuperable difficulties in these remote regions. The Negro is hostile in general to activity of the sort required, and he is besides not healthy enough to do a satisfactory amount of work. In order to overcome these difficulties, a colonial structure has been set up that forces the native into wage labour, and increases his productive capacity to a certain extent.

The policy of increasing the Negro's labour capacity would be truly beneficial if it were carried out scientifically, and not as it is usually done. Some colonial administrators soon realized that a profitable exploitation of colonial territory required, first of all, the strengthening and fortifying of the native population, something that had been entirely neglected at first. In the Belgian Congo, for example, at the end of the First World War, the native population had declined by about a fourth. The Governor-General of the colony, M. Lippens, wrote in 1920 that "the Congo has seen its native population disappear with incredible rapidity, because we neglected salads in favour of rubber and ivory".

Since he needs the Negro worker as an essential cog in the colonial machine, the smart administrator undertakes to defend and protect the Negro labourer. This is the policy picturesquely expressed by a French colonial governor as: "It's necessary, first of all, to make the Negro." That is, Negroes must be produced in sufficient quantity for the labour needs of the colony, and Georges Hardy says that toward this end M. Carde declared that it was absolutely essential to have a "full-belly policy". But when it comes to carrying out the policy, any good intentions which may have existed break down. The native worker at the mine, mill, or plantation may get a stomach full of rice, or corn, or manioc meal. But this sort of stuffing, rather than improving his overall state of nutrition, has the effect of greatly aggravating any specific deficiencies he may have.

The European colonizer, when he offers the Negro a larger quantity of food than is normally available in the native village, is merely trying to attract workers, and to provide them with a quantity of energy which he expects to get back in the form of productive work. What he is really providing is not better nutrition, but merely an abundance of fuel. The same thing is happening in Africa, right now, that happened in tropical America in connection with the feeding of Negro slaves. The slave owners, anxious to get as much production as possible, always took care to provide them with reasonable quantities of beans, corn, manioc, and bacon. It was a diet that kept the slaves in apparent good health, and made possible the hard agricultural labour demanded of them. This policy of the plantation owners of Brazil and the Antilles was erroneously interpreted by a certain Brazilian sociologist unfamiliar with the complexities of such biological problems; he was led to the mistaken conclusion that Negro slaves were one of the best-fed groups in the colonial population. This was never true. The slave's diet was bulky, but it was always bad.

The so-called full-belly policy greatly worsened the nutritional situation of the Negro in Equatorial Africa. Bigwood and Trolli observed that the Negro showed much more frequent signs of dietary deficiency—particularly beriberi in both its dry and dropsical forms—after entering the service of the colonizers than he had before. Innumerable cases of rickets, beriberi, and scurvy have been noted in Tanganyika. The nutritional situation is especially precarious in the mining districts, where fresh foods are practically unknown. In fact, pellagra has been observed in Nigeria and the Gold Coast.

There are two other practices aimed at securing native labourers which do not speak at all well for colonial policy. One is to limit sharply the land available to the natives, and the other is to make taxes payable only in money. The first, or land reserve system, consists of restricting the native population to areas insufficient to provide for their needs, which forces them to leave the reservation in search of work. A good example of this system, found in the territory of Kenya, has been described by Gourou. In 1939, 3,000,000 natives of this colony were restricted to reservations of only 100,000,000 square kilometres, whereas 21,000 whites (1,600 of them owners) enjoyed an area of 40,000. In Southern Rhodesia, 60,000 Europeans have the use of 185,000 square kilometres, while 1,500,000 Negroes are crowded into an area of some 115,000. The compulsory payment of high taxes in cash also limits the Negro's freedom of choice, and forces him into colonial wage labour.

When these methods do not produce the desired results, the colonizers in some areas go even further. They set up a feudal labour system that has many of the characteristics of slavery itself. As late as 1945, according to Gourou, the administration of the Ivory Coast recruited labour by military draft, and the workers were "badly paid and badly treated".

In the savanna region, nutrition is generally a little better than in the forest. This is the area of coarse grasses and scattered trees, where in addition to unproductive laterite there are scattered strips of alluvial soil, and highly productive swamp land. The two well-defined seasons offer favourable conditions for the development of agriculture, and make this area much better adapted to farming than the jungle. Thus the savanna, midway between hostile jungle and hostile desert—one too wet and the other too dry—represents a kind of oasis within tropical Africa. In its enormous area of almost a million and a half square miles lives a population devoted primarily to agriculture and cattle raising. An abundance of fruits and animal products reinforces the protective elements of the regional diet. In certain zones where cattle raising is relatively intensive, the nutritional level is among the best in the world, comparing favourably with that of some of the Berbers of the Sahara. The pastoral Masai tribe studied by Orr and Gilks, and certain pastoral peoples of British Somaliland, offer examples of this well-balanced diet, rich in animal proteins. These Somali tribes, who live in a steppe zone transitional between savanna and desert, use a diet based upon milk—camel, cow, sheep, or goat—which they consume at a rate of 5 quarts a day per person. Meat, ghee, dates, and rice round out a diet that makes the Somali gaunt but tall, and gives him magnificent physical resistance. Though they do not eat fruit, which is exceptionally rare in this semi-arid zone, the inhabitants of Somaliland never show signs of vitamin deficiency.

But though the peoples of the Sahara border regions enjoy good physical health, those who live on the fringes of another African desert in the southern hemisphere, the Kalahari, do not. These are, in fact, one of the most decadent strains on the continent, the disappearing race of Bushmen. They are nomadic tribes living exclusively on game and the few wild products of the region. Everything about the Bushmen, beginning with their stunted growth—they average less than 5 feet in height—bears witness to their precarious health and living conditions.

4

Nutrition is generally bad in the Black African tropics. On should not jump to the conclusion, however, that climate alone, b making human labour difficult and by creating infertile, quickly exhausted soils, is the reason for the miserable food situation of th continent. There are human groups outside the torrid zone wit diets just as bad, or even worse, than those of tropical, equatoria Africa. This is the case in the Union of South Africa, and in th British South African territories of Basutoland, Bechuanalan and Swaziland.

Except for a little piece of the Transvaal, the Union of Sout Africa lies entirely below the Tropic of Capricorn; and since th average altitude is 3,000 feet, the country enjoys a typical temperat climate. Nevertheless, in this fine climate to which some 2,000,00 Europeans have adapted themselves, there are still great masses o human beings who are undernourished and starving. These are no entirely natives. Many of them are of European origin—th notorious “poor whites” who constitute such a serious socia problem for the Union.

It cannot be denied that food conditions have definitely improve in recent years, along with the rise in living standards provoked b the last war. This improvement is shown by the fact that the Unio of South Africa used to export considerable quantities of corn butter and fruit to England, but since the war these products hav been used up within the country, and still more imported. Variou investigations have found that increased wages of both European and natives, resulting from industrialization and the prosperit brought by the war, have resulted in “a definite increase in foo consumption”.

Improved living conditions, however, do not extend to th marginal populations, who continue undernourished. In 1932, whe a scientific mission of the Carnegie Foundation studied the proble of the “poor whites” in South Africa, their number was estimate at about 220,000 individuals, or more than 10 per cent of the tota white population. According to the experts’ report, the principa reason for the decadence of these white populations is their deficien diet: “Conditions of poverty and ignorance lead to lack of food an to wrong diet. This weakens the resistance of the poor white t disease, reduces his working power, and so makes the problem mor acute.” I have no current figures on the number of “poor whites,” but I know that the Welfare Department is continuing its policy o economic aid to these groups throughout all the provinces of th Union.

As to the Bantu or Kaffir populations, estimated at som

7,500,000 individuals, the greater part are restricted to an extremely deficient diet. When the Dutch settlers first appeared in this area, they found native tribes of strong, healthy people who lived by raising cattle, growing corn, and hunting wild game. But the natives' long years of struggle with the invader, ending in loss of their lands and segregation of half the population on reservations, disorganized the native economy completely. Today the diet is almost exclusively corn.

In Transkey, the Inspector of Schools, J. H. Dugard, reported that out of 11,000 children observed, 84 per cent had only one meal a day; 14·9 per cent had two; and no more than 0·6 per cent received three meals a day. In all cases, the meals were made up of corn in one form or another. Drs. Joseph and Theodore Gillman have written that only 40 per cent of the children received milk during even a small part of the year, and 8 per cent consumed green vegetables. With this almost exclusive corn diet, it is no wonder that nutritional conditions among the Bantus are precarious, and deficiency diseases frequent.

An especially striking and noteworthy fact is that pellagra, unknown in this area until forty years ago, has now become endemic. During the period 1942–45, more than 2,000 cases of pellagra were admitted to the Johannesburg Hospital. In a period of four years, Drs. Joseph and Theodore Gillman registered 4,000 cases in the same region.

Nutritional conditions in the English colonies of the extreme south are even worse than those in the Union of South Africa. In Basutoland, for instance, where the climate is subtropical and the average altitude 7,000 feet, the agrarian population subsists on a diet very short of protective elements. The following statement is from the report of the Committee on Nutrition in the Colonial Empire: "A high carbohydrate diet and serious lack of protein, fat and vitamins prevails throughout the whole country." With such a diet, the population is naturally in poor health, and reveals typical deficiency diseases such as pellagra, scurvy, beriberi, etc.

The worst part of it is that malnutrition and hunger have grown more acute in recent years. Here is what the Committee's official report had to say about that: "According to residents of long standing, the physique and health of the Basuto today is not what it used to be. Malnutrition is seen in every village, dispensary, school, and recruiting office. Mild scurvy and subscorbutic conditions are not infrequent; pellagra is becoming more and more frequent and lower resistance to disease increasingly apparent. It is becoming generally accepted, too, that the occurrence of leprosy is associated with faulty diet."

It is interesting that the population of Basutoland has doubled in the last forty years, making it one of the fastest growing populations in Africa. This gives further support to my theory that hunger is a factor leading to overpopulation.

The protectorate of Bechuanaland is a pastoral colony, devoted almost exclusively to the cattle raising and dairy industries, but in spite of this, its nutritional situation is very precarious. What happens is that the products of these industries, instead of being consumed locally, are exported, principally to the Union of South Africa. As a result, populations of the territory are found to be living "on a very poorly balanced diet and suffering from a serious lack of vitamins, which may show itself in frank manifestations of nutritional disease or as a lack of resistance to other diseases".

As compared to the other two British territories in South Africa, food conditions in Swaziland may be said to be a little less black. Children alone, and not adults, show signs of dietary deficiency. The absence of vitamin diseases in the mature population is believed by nutritionists to be due to the habitual use of certain native plants which upon analysis reveal a high vitamin potential.

However sketchy, this panorama of nutrition and food supply i the lands of Africa shows the Black Continent to be beyond questio one of the darkest spots on the world's map of malnutrition an hunger. There is hope, though, that this horrible blot may soo begin to lighten. As a result of the political ferment in Asia, and th loss of a large part of the Far Eastern colonial empire, Europea powers as well as the United States are looking to Africa with renewed and special interest. This is particularly true of the principa colonial landholders of the continent, England, France an Belgium.

England has projected a plan for the development and economi expansion of Africa which calls for the expenditure of a billion an a half dollars, and in this plan the biological recuperation of th African, by means of better nutrition, has not been forgotten. Dam construction projects designed to promote irrigation and contro lakes and rivers will surely lead to an expansion of agriculture as wel as to a relative industrialization of the African continent, an these might well have favourable effects on the life of the loca populations.

Everything depends on the attitude Europe takes toward colonia policy in these years so decisive for western civilization. Grandios projects like the British peanut plantations in Kenya and Tanganyika, where $100,000,000 was invested in hopes of reachin an annual production of 60,000 tons of oil within 5 years, or lik the French project of planting 160,000 hectares of land to peanut in Senegal, run the risk of making the African situation worse tha ever unless the biological and economic interests of the native ar taken into consideration. After all, the success of these ventur depends largely on his effort and co-operation.

To justify these huge investments in African economic expansion, European economists argue that Africa today bears the relation to Europe that the American Midwest bore to the East in the middle of the past century. In other words, it is a region of great potential wealth, capable of furnishing food and raw materials to the great industrial centres. But if there is to be any such parallel, social relations as well as geographical convenience must be taken into account. The American Midwest enjoyed a wonderful growth and development because at the same time that it supplied the East it was forwarding its own regional economic interests. On this policy of mutual interests the greatness of the United States was founded.

If Europe wants the help of Africa for her economic recovery, she too must adopt a policy of mutual interests, and grant Africa the right to a decent living. And the most fundamental right of any people is the right to an adequate and balanced diet. So long as this right is denied the people of Africa, they will hardly co-operate wholeheartedly in the plans laid out by Europeans. The fact is, Elspeth Huxley says, that "in spite of many obvious benefits derived and others promised, they have shown increasing distrust of the white man's intentions, and growing reluctance either to believe what he says or to play their full part in working with him toward economic prosperity".

The geo-politicians such as G. I. Renner assert that under the present conditions of international politics Africa, located as it is between Europe and Asia, will play a leading part in the strategic control of the world. Africa is, in my opinion, strategically important to the present world crisis in another sense. I am thinking not of a political but of a biological crisis: the lack of sufficient food resources for an ever increasing population.

Whoever controls Africa will have strategic control of enormous potential resources. But these resources can be developed only by native muscles. And these muscles will not have strength for the job so long as they are the muscles of starving people, wasted and weakened by the famine and slow starvation that wrack the continent of Africa today.

CHAPTER VI

STARVING EUROPE

MONTESQUIEU, IN THE middle of the eighteenth century, stated that "Europe is nothing but several nations in one". The celebrated French philosopher was too optimistic. Social and political events of the last two centuries have failed completely to bear out his theory of European political unity.

The Europe of today, on the contrary, far from presenting the unity and economic structure of a nation, reflects a world of conflicting interests. In the face of current reality, we would have to paraphrase Montesquieu somewhat as follows: "Europe is nothing but several worlds in one"—or two at least: the capitalist West, and the soviet East. For through the very heart of Europe, cutting across the area that the English geographer Halford Mackinder christened so expressively the "world heartland", passes the line of demarcation dividing the earth into two areas of different outlook and social aspirations. This division into two cultural worlds is the prime characteristic of Europe's economic and social life, and constitutes the first obstacle to a study of the region as a unit.

Even before the so-called "iron curtain" separated Europe into two great water-tight compartments, the continent was a meeting ground for several cultures: the Atlantic, the Slavic, and the Mediterranean. These differing worlds marked European civilization, in varying shades and degrees, with their multiple influences. And, further complicating European life, no other region on earth has lived in such continuous and absolute economic dependence on the rest of the globe.

It is obviously difficult, therefore, to study hunger and malnutrition on a continental scale where there are such well-marked local differences and such paradoxical and confusing contrasts. But I shall try to overcome the obstacles, and to sketch a portrait of the continent that will reveal the signature of hunger on the face of the land, and on the faces of the people who inhabit this many-sided and turbulent European world.

First of all, in keeping with our geographic method, we must accurately establish the limits of the area to be studied. The United Nations is the best source of information on the region, and in accordance with its viewpoint, we take Europe to be the more westerly portion of the Eurasian land mass, including all countries lying west of the U.S.S.R. In a strictly geographic sense, there is no question but that part of the U.S.S.R. is European, though it is customary nowadays to consider the Soviet Union as primarily an Asiatic power, economically separate from Europe.

Within the limits thus established, Europe has an area of some 2,200,000 square miles (4 per cent of the surface of the globe), and a population of about 420,000,000 (20 per cent of the world's inhabitants). Against the varied scenery of this narrow stage, human beings have, from the earliest times, been acting out the interminable drama of hunger.

One climax in this drama was reached during the Middle Ages, when devastating famines swept tremendous areas of Europe. The feudal system, with its huge and unproductive land holdings, reached its peak during this period. The closed seignorial domains were almost completely independent of each other, and whenever some accidental factor caused a decline in local food production, the result was general starvation.

The territory of Europe was at that time divided into huge estates averaging, according to Henri Pirenne, 1,600 acres, with most of the land unused and "covered with woods, marshes, and swamps". There was no external market for local products, and therefore no reason to expand production. The feudal lords produced only enough for the basic needs of their serfs—subsistence items for immediate consumption. This limited production was the cause of the successive scourges of hunger during that dark period of history, when the human masses of Europe alternated, as Cruschmann put it, between "a stupid and hopeless apathy, or an intense mystic fervour". Their hunger, sublimated in fanaticism, found an outlet in bloody religious wars.

Between the tenth century and the Renaissance, according to the historians, some 400 widespread famines racked the countries of the Continent and the British Isles. Cornelius Walford, in his famous study of the world's famines, lists 22 major ones, with their tragic train of miseries, in thirteenth-century Europe alone. During many of these periods of acute hunger, cannibalism was practised and there was traffic in human flesh. In a study of the scarcity of food in medieval England, William Farr states that there were 20 great famines in that country during the eleventh and twelfth centuries.

In their misery, the famished populations of Europe resorted to all sorts of wild herbs, roots, and the bark of trees; and during the winter practised a kind of collective hibernation analogous to that of certain animals. Whole villages would spend four or five months of the year in a state of torpor, "lying down most of the time, moving as little as possible and then only to satisfy the most indispensable necessities," according to Nilam Maurizio. As a survival of the customs and conditions of the Middle Ages, this practice of inducing artificial sleep continued in some parts of Czarist Russia (where it was known as *lyoschka*) into our own country.

The discoveries of the great navigators in the sixteenth century made available to Europe the food resources of other continents. Famines became milder and less frequent, but continued nevertheless to do tremendous damage. In 1586 England was shaken by one of the worst famines in her history, and in 1662, around Blois, in France, peasants pastured in the fields like cattle, gnawing thistles and roots. During various hungry years of the seventeenth century, E. Parmalee Prentice has said, "men and women with their mouths full of grass were found lifeless by the roadsides of Europe, and children in the cemeteries sucked the bones of the dead." Prentice says with reason that food shortages did not cease with the Renaissance in Europe, but continued "with decreasing frequency in England, nevertheless with much suffering, even into the eighteenth century; and in France the lack of food, following the short crops of 1788, was one of the moving causes of the great Revolution of 1789".

The eighteenth century was rocked by recurrent famines, and in the second half it seemed as though all possible adverse factors conspired to keep the Continent in a permanent state of hunger. The starvation that reigned between 1769 and 1789 was without question a decisive factor in the outbreak of the French Revolution. In his detailed study of the Revolution, Taine pointed to hunger and misery as its principal causes. His description of the times is often unusually vivid and expressive, as this passage shows:

> Two causes excited and maintained the universal agitation. The first of them was the permanent food crisis. Lasting for ten years and aggravated by the violence provoked by hunger itself, it served to inflame popular feeling to the point of madness. . . . When a river runs level with its banks, only a small rise is needed to make it overflow. Such was the misery of the eighteenth century. The man of the people who lives with difficulty, even when bread is cheap, sees death staring him in the face when the price goes up.

Taine then goes on to present evidence of the collective misery of the nation. In Normandy a quarter of the population was reduced to begging. The Town Council of Rouen wrote to the King that the people could not pay the high price of bread, and remarked, "what bread it is, even for those able to buy!" The number of indigents tripled in Paris, and misery stalked both city and countryside. The Bishop of Chartres testified that "men were eating grass like sheep, and dying like flies". According to testimony of the period, "as the 14th of July approached the hunger grew worse. Each bakery was besieged by a multitude. Bread was distributed with extreme parsimony. And this bread was generally black, bitter, and full of clay. It caused inflammation of the throat and pains in the stomach." And

Taine adds that in the long and agitated queues at the doors of the bakeries, dark thoughts fermented. This was the background of the great explosion, when a famished people scaled the walls by thousands, led on by the hope of better days.

The victorious principles of the French Revolution improved the lot of the people of Europe, but did not bring about the end of hunger. The abolition of serfdom assured personal liberty, but the landholding system changed very little except in France. Feudalism continued in full force; in fact, many of its characteristics have lasted practically to our own day.

The survival of monopoly landholding guaranteed the survival of hunger on the European continent. Nevertheless, the growth of industrial capitalism in the last century, along with the development of transportation and trade, has made outright famine more and more unusual in time of peace. The last great calamity of this sort in western Europe occurred in 1846 in Ireland; a million people starved to death, and still more fled the country to escape the same fate. The Irish famine, occurring in the industrial era, can only be explained as the result of landlordism. The land of Ireland was monopolized by a tiny number of English conquerors, while practically the whole of the Irish population was reduced to a sharecropper status. It was the agrarian problem in its most acute form that caused the catastrophe of 1846 in Ireland.

Although actual famine disappeared except in time of war, the industrial revolution, and the concentration of the urban proletariat which it effected, created tremendous new problems of food supply. The result was a régime of chronic hunger. Great masses of the population in extensive areas of Europe were subjected to a permanently deficient diet. Like the famines of the Middle Ages, this chronic hunger is closely related to the peculiar social structure of the times. The chronic hunger in many parts of contemporary Europe is of central importance in understanding much of the recent history of the continent, especially its political history. Here lies the explanation of many of Europe's wars and social agitations.

Michelet correctly said that the history of France up to the great Revolution, "with its crescendo of miseries accumulated from century to century, will never be understood until a terrible book has been written—the History of Hunger," And E. P. Prentice observed that if this book were written, a new light would be shed on the history not only of France but of the whole world—because in all ages, and in all parts of the world, men have suffered from hunger.

The full history of hunger in Europe is an exceptionally rich line of investigation that awaits detailed study and objective interpretation. But to write such a history is not the purpose of the present study. This is a Geography of Hunger, and geography is concerned with the present, not the past. Geography is the study of living reality; it is the analysis of facts as they are at the moment when we live and observe them. Such historical events as we have noted in passing are intended merely to bring us to a vantage point, for it is often impossible to understand the present without some knowledge of the past, and in such cases geography must resort to the historical method as a complementary approach.

In order to understand the food situation in present-day Europe, we must know something of conditions there before the last war, and of the changes that have taken place during and since the war.

I

In 1929 the German philosopher Oswald Spengler gave a lecture at Hamburg in which he called for the revival of Germany, and her preparation for a role of world leadership. The Nazi coup of 1933, which permitted Hitler to seize power, fulfilled part of this demand. Spengler then published his lecture in expanded form with the expressive title, "Years of Decision" (*Jahre der Entscheidung*). So far as the title went, Spengler's words were really prophetic—during the decade that followed his famous lecture in Hamburg, Europe, and in fact the world, lived through some of the most decisive years of their history.

During this period, the lamentable nutritional conditions of the majority of the peoples of Europe became known, not only to a limited circle of specialists, but to the world at large. Until then, it had been generally assumed that the problem of food supply in Europe was difficult, but that a high level of industrialization, together with large-scale importations, kept the population pretty well fed. The experts of the Special Food Committee, set up by the League of Nations in 1935, demonstrated that the situation was in fact quite different. Their investigations made it clear that Europe was a great hunger area, with dense groups of the population permanently subjected to diets that were both insufficient and incomplete. Great Britain was importing two-thirds of her food, Belgium and Norway 50 per cent, Holland 30 per cent, and Germany 25 per cent, but with all their efforts, these countries were not supplying a balanced diet to their concentrated populations. It was also found that even in such countries as Hungary, Rumania, Poland, and Yugoslavia, where there was an excess of food energy available for export, the diet of the peasants was precarious indeed, even worse than in the western nations with agricultural deficits.

Lord John Boyd Orr studied British alimentation in 1936, and concluded that about 50 per cent of the people suffered from inadequate diets. This half of the population included the 10 per cent with the lowest incomes, whose diet was deficient in all the essential elements of nutrition; 20 per cent with somewhat higher incomes, whose diet was sufficient in quantity, but lacked various protective elements; and another 20 per cent with certain specific deficiencies of vitamins or mineral salts. The sensational revelations of Lord Boyd Orr and his collaborators, concerning a people presumed to enjoy a living standard among the highest in Europe, made a profound impression, and were even received with a certain reserve. But a new investigation carried out in 1936 and 1937 under the direction of Sir William Crawford confirmed the figures of Lord Boyd Orr in full. The truth was that England suffered on a large scale from various types of specific hunger, such as rickets and alimentary anaemias.

The famous "Medical Testament" that followed was brought out by a committee of doctors in an English county, The Local Medical and Panel Committee of Cheshire. It is one of the most eloquent and unanswerable documents ever to describe the grave effects of malnutrition on the biological characteristics of the British people. The 600 regional doctors, in a statement that had world repercussions, said that they were charged by law with the prevention and cure of disease, that they were able to accomplish a certain amount so far as the cure of certain ills was concerned, but that they could do nothing or almost nothing toward preventing them—because most ill health was due to the use of a permanently defective diet:

> Of the first item, the prevention . . . of sickness, it is not possible to say that the promise of the Bill has been fulfilled. Though to the sick man the doctor may point out the causes of his sickness, his present necessity is paramount and the moment is seldom opportune, even if not altogether too late for any essay in preventive medicine. On that first and major count the Act has done nothing. Our daily work brings us repeatedly to the same point: "This illness results from a lifetime of wrong nutrition." The wrong nutrition begins before life begins. "Unfit to be a mother"—from undernutrition or nutritional anaemia—is an occasional verdict upon a maternal death. For one such fatal case there are hundreds of less severity where the frail mothers and sickly infants survive.

This impressive document reveals the alarming amount of tooth decay found among children, and the high incidence of various degrees of rickets, as well as of other diseases indicating a state of chronic malnutrition.

The bad nutritional condition of the British people was due, in part, to the limited amount of arable land available, and to the consequent dependence on large imports from abroad. But the fact is that even the available land was not adequately used. The deficiencies of the British system of land use were making the situation much worse than was necessary. This was demonstrated during the last war, when emergency measures were adopted that changed the food situation completely.

Serfdom had been abolished at the end of the Middle Ages and the peasants were given land. But in modern times, and especially in the nineteenth century, small holdings progressively lost ground to large estates, and the result was an extreme concentration of land in the hands of landlords. Thus the latifundia were created, and with them the class of farm labourers—juridically free, but economically bound in strict dependence to the noble landlords. Henri See had this to say on the English agrarian system:

> The nobles do not work their lands, but rent them out to farmer contractors. These contractors differ from the general farmers of ancient France in that they are agricultural entrepreneurs; and from the peasant farmers because they direct large-scale activities, and by their culture and living standards belong to the bourgeoisie. The results of this economic revolution have been extremely serious. England grows less and less cereals, because ploughland has been converted into pasture to make it easier to manage.

Spain is another country where hangovers of agrarian feudalism are responsible for one of the lowest nutritional standards on the continent. Various indications of dietary deficiency have long been recognized among the people of Spain. Pellagra is endemic in Galicia and Asturias, while goitre is common in various parts of the country. But the real state of dietary deficiency in Spain has only recently been described in scientific terms.

During the Middle Ages Spain was better fed than the rest of Europe. This was a result of the culture of the Arabs, who occupied a large part of the country and set up, particularly in the irrigated lands of the south, an intensive, diversified agriculture based on fruits and vegetables. The gardens and orchards of Moslem Spain that made Andalusia famous in the tenth century had a highly favourable effect on the regional diet by making it rich in protective elements—mineral salts and vitamins. In his book, *La Peninsula Iberique au moyen-age*, Levy Provençal refers to the striking variety of produce in these Mohammedan gardens: oranges, dates, pomegranates, almonds, and figs were grown, as well as other plants in magnificent profusion. W. Gordon East, in his *Historical Geography of Europe*, goes so far as to make the flat statement that in the middle of the tenth century, the agriculture of Spain was without a rival in Europe.

Nevertheless, under the influence of various factors over the years, this excellent agricultural and nutritional tradition has been largely lost. It is hard today to understand why a country as large as Spain, with almost 200,000 square miles of surface and only 25,000,000 inhabitants—an exceptionally low density of population for western Europe—should now be unable to supply its people with a balanced diet. But all becomes clear when we remember that with the Reconquest, feudal land relations were re-established, and remain practically intact today.

F. Osborne attempts to explain the decadence of Spanish agriculture by the exhaustion of the soil, and by the erosion of steep hillsides long ravaged by the flocks of nomad shepherds. The organization of sheepraisers known as the *Nesta* enjoyed considerable political influence during the fifteenth and sixteenth centuries, according to Osborne, and contributed greatly to the destruction of forests and the ruin of the soil. It is my impression, however, that the feudal land system has been a much more important factor than erosion in creating the miserable dietary conditions of Spain. No other country of Europe has preserved the great estates on such a scale as Spain, and this situation is directly contrary to the biological and economic interests of the majority of the population. Until the fall of the monarchy in 1931, Spain had a typically medieval agrarian system, with the best arable lands monopolized by a handful of great landlords.

The American writer Leland Stowe, studying Spain on the spot, had this to say:

> Before the Republic—as is still true under the Franco-Phalangist counter-revolutionary régime, and will be true under any conceivable restored monarchy—about 50,000 large landowners held a monopoly on more than half of Spain's land, including all of its richest portions. Some estimates numbered the big land-monopolists at not many more than 20,000. Thus the Spanish aristocrats, constituting one five-hundredth or less of the total population of some 24,000,000 people, owned about 51 per cent of the land; and wealthy farmers another 35 per cent. About 1,000,000 small farmers, with parcels of some 12 acres, held another 11 per cent of the land. This left 1,250,000 peasants, with barely one acre apiece, and representing 2·2 per cent. And it left more than 2,000,000 Spanish labourers landless, and at the mercy of whatever the grandees and other propertied landlords chose to pay them for working from one-third to two-thirds of the year.

When the Republic was established, the agrarian question was one of the most acute that the government had to face. In certain regions such as Andalusia and Estremadura, an archaic property system kept more than 60 per cent of the arable land out of use, while the remaining 40 per cent was inadequately cultivated. Salvador de Madariaga remarks that "in these regions there were a few landlords with enormous tracts of land, surrounded by a landless proletariat whose subsistence depended on the whims of the lord's overseers."

The Republican government attempted to solve the agrarian problem, but never succeeded in accomplishing its basic objectives. The whole world knows what happened. Leland Stowe describes it as follows:

> Then the Spanish Republic launched a modest beginning at redistributing a few great estates—with moderation to a surprising degree and with fair remuneration to the owners. Even this gradual and restrained effort was more than Spanish dukes and grandees, with their medieval mentality and pronounced lack of social conscience, would tolerate. The great feudal landlords, the army, the monarchists, and the Church united, as throughout a long past, and joined the counter-revolution headed by Franco and backed by Hitler and Mussolini. They won again. As far as landed privileges are concerned, Franco's Spain is still the Spain of Ferdinand and Isabella.

With the outbreak of the Spanish Civil War in 1936, the food shortage became much worse, and famine created macabre scenes of starvation in violent colours against the background of chronic hunger. During the last two years of the Civil War, Spain suffered from the same types of hunger as had Europe during the First World War, with the deaths from starvation hardly fewer than those on the field of battle. Dr. Pedro y Pons observed the extreme nutritional poverty of the civil population in the so-called "Red zone," the part of Spain occupied by the Republicans. This specialist reported that a majority of the population was forced "to accept a desperately monotonous and restricted diet—an unvarying fare of lentils boiled without oil, plus—part of the time—a scrap of bread." Because of the scarcity of more nutritious foods, and the astronomically high prices, "for many months the majority of the population got no fish, meat, eggs, milk or olive oil." This majority had to limit itself instead to bread soup and lentils, or to chickpeas and wild plants. Bands of the starving combed the fields for roots and leaves with which to delude their hunger. Thistles, pigweed, and poppies cooked in brine were life-savers at such a time. Again Europe had gone back to harvesting the weeds of the fields, once called the "market garden of misery".

When a diet is so extremely deficient in many nutritional elements, various serious conditions appear. Pedro y Pons registers them with an abundance of detail: hunger oedemas, deficiency dysentery, deficiency bone diseases, nutritional anaemias; and above all the terrible increase of pellagra, which took lives right and left. According to Ed. Simonart, some 30,000 cases of pellagra were registered in Madrid in a single year.

The pre-war situation in Italy was not much better than that of Spain. The fertile soils of the North were densely populated, while the soils in the south were poor and badly eroded. In order to support her people at even a modest standard, Italy was for long the largest wheat importer in continental Europe, with a gross annual importation of some 80,000,000 bushels of cereals. The needs of the fascist armament programme gradually cut down this figure, to the point where only a fourth as much—20,000,000 bushels—was imported in 1935. This reduction of wheat importations had disastrous effects on the health of the Italian people, workers or farmers. As a factory worker in Rome told me in 1938, there was only one thing to do: take up their belts another notch. The Italian diet had always been defective, overloaded with cereals and deficient in animal proteins and certain vitamins. And now, in the decisive years of preparation for war, it became still more precarious.

The conquest of Abyssinia did little to improve the situation. High freight rates added so much to the cost of products shipped in from the celebrated Italian Colonial Empire that they were out of reach of the poorer classes. Pellagra had practically disappeared from Italy after the First World War, but now, with the lack of meat and other protective foods, it flourished again on a considerable scale.

Nutritional conditions reached the lowest level in the south, in the region the Italians call *Mezzogiorno*. There, subsistence was particularly difficult because of the agrarian crisis created by the problem of the great latifundia, on which the peasants or *cafoni* were kept in a state of semi-slavery. The plantations produced wheat, beet sugar, oranges, and other foods, but all this was exported to the more socially advanced centres of the country, while the southern peasant was reduced to permanent starvation. The Italian novelist Ignazio Silone described the misery of southern Italy in his book, *Fontamara*, which dealt with the Fuccino region, in Marcia:

> The beets of Fuccino constitute the raw material for one of the most important sugar mills in Europe. But for the *cafoni* that raise them, sugar is a luxury that appears on the table only at Easter, for the ritual cake. Furthermore, practically all the wheat of Fuccino is sent to the city, where it is used to make white bread, paste, cookies, and even special foods for dogs and cats, while the *cafoni* that cultivate it are forced to live, practically all the year, on corn. What the *cafoni* get from Fuccino may

> be considered a true and legitimate hunger income—an income that permits them to keep on living only, but never lets them get ahead.

The Prince Torlogni of Silone's novel, like the good plantation owner that he is, never leaves any more for the peasants than is strictly necessary to keep them alive, and to keep them working his land. All the rest he sends to market and converts into hard cash, so that he can live luxuriously in the capital.

Another book that faithfully portrays the southern part of Italy is *Cristo si é fermato a Eboli*, by Carlo Levi. Here is his description of the food situation in Lucania:

> The rich eat a little bread and cheese, a few olives and dry figs. The poor eat nothing but bread throughout the year, with a raw tomato smeared on it once in a great while, or a little garlic or green pepper.

With such a diet it is no wonder that the children of the region look as Carlo Levi describes them, "pale and thin, all of them, with great, dark, melancholy eyes in their waxen faces. Their swollen bellies are like drums, stretched and mounted on thin and twisted legs."

Elizabeth Wiskemann rightly judges that even today "the regions of Calabria, Lucania, and Apulia are the Achilles heel of Italy and perhaps of Western Europe as a whole. Their problem is basically agrarian, and it is intricate because of endless local diversity." And this hunger area has the highest birth rate in all Italy—another vivid example of our theory of hunger as a factor in population growth.

Now let us take a population group living at the opposite end of the European continent—in the extreme north—and see how well they were being fed in the years before the war. Surveys made in Sweden indicate that nutritional conditions there were quite a bit better than any we have noted so far, but were still far from perfect. Various sectors of the population showed signs of deficiency. Some 15 per cent of the individuals studied, for instance, were not getting enough total calories; 27 per cent revealed a deficiency of vitamin A, 36 per cent of vitamin B_1, 43 per cent of vitamin B_2, and 14 per cent of vitamin C. A League of Nations survey of medical and social conditions carried out in 1929 and 1930 demonstrated a close relationship between the above dietary deficiencies and the incidence of certain diseases of the blood and digestive tract.

The economic structure of the eastern European countries was predominantly agrarian. However, in spite of an excess food production that made many of them exporters and suppliers of grain to western Europe, their populations suffered from all kinds of nutritional deficiencies. In Rumania, which is considered one of the principal wheat granaries of Europe, pellagra has never been wiped out. According to observations made by Dr. W. R. Aykroyd in 1933 5–6 per cent of the inhabitants of Moldavian villages were attacked by pellagra every spring. A nutritional survey in this area indicated that the habitual diet was extremely deficient in proteins, in calcium, and in vitamins. In Hungary, "the basic foods were bread, dry beans, beets, potatoes, cabbage, and bacon. Even those with means rarely ate beef and mutton, and pork only occasionally. Hardly anybody consumed milk, eggs, fowls, butter, green vegetables, and fruits. The overall diet, therefore, was extremely deficient in all the groups of protective foods. The F.A.O. found that the diet of Polish peasants consisted almost exclusively of potatoes and rye, with obvious deficiencies in proteins, minerals, and vitamins." Rickets and xerophthalmia have been endemic to Poland and Hungary from medieval times to our own day.

How can we explain this lack of balance in these essentially agricultural countries between the productive capacity of the land and the food needs of human groups? Various factors stand in the way of the desired balance: the use of outmoded farming methods: a lack of financial assistance to the farmer; and the frequent disproportion between the low prices the peasant gets for the product of his labour and the high prices he pays for the industrial products he needs. There is no doubt, however, that of all the factors that maintained hunger in central and eastern Europe until the last war, the most important was the topheavy system of landed property. Enormous latifundia, hangovers of feudal times, existed side by side with tiny farms too small for family subsistance. Take Poland, for example, with its high density of rural population representing, in 1935, 61 per cent of the national total. On the one hand there was excessive subdivision of land among the peasants; and on the other, the Polish government tells us, monopolization of 20 per cent of the arable land and 50 per cent of the forests in the hands of a tiny group of great landholders. In 1921, according to Raymond L. Buell, 65 per cent of Polish farms were of less than 30 acres—dwarf farms, that is, incapable of sustaining a family. In addition, some 4 million peasants had no land at all. This shortage of land for the peasants was a result of the fact that about 43 per cent of the country's total cultivated land was taken up by the huge estates, belonging to 19,000 great landowners.

However, the most notable hangover of feudalism—the most shocking and scandalous land monopoly in Europe, worse even than Spain's—was to be found until the last war in Hungary. For many years the Hungarian feudal nobility was the only political force of any weight in the country, and so was able to keep its privileges, handed down from feudal times, intact. Out of 60 million acres of arable land in Hungary, according to M. W. Feder, some 20 million, or a third, were the property of four thousand landed proprietors. Studying the plantation system of Italy, Silone gave us Prince Torlogni, owner of all the land and wealth of an entire region. But he was only a character of fiction. Leland Stowe, studying the system of latifundia in Hungary, gives us a list of the twenty-five greatest landowners in the country, with real, not fictional, names. The list runs all the way from Prince Paulo Eszterhazy, who owned the biggest estate in the nation, some 300,000 acres, down to the Hungarian Catholic Culture Fund, which was placed twenty-fifth with a modest 45,000 acres. Aristocrats and members of the royal family stand out in the list of biggest landholders, along with the orders and institutions of the Roman Catholic Church. That is one of the reasons why the nobility and the clergy were always stubbornly opposed to any and all agrarian reform.

The living conditions of rural workers in these feudal domains were naturally extremely low. An American journalist, Theodore Andrica of the *Cleveland Press*, travelling through the country in 1938, noted that their average wage was about twenty cents a day, "in season, when they could work."

These examples are enough to give a general idea of the food situation in Europe during the years of ferment before the great world conflagration, when Germany was preparing to make Spengler's prophecies come true. Even with all its dietary deficiencies, with a round third of the population living on a chronic hunger diet, Europe could not survive without importing huge quantities of food: 9 million tons of bread cereals, great quantities of forage for the cattle, fertilizers to feed the worn-out soil, and fats for food and for industry. The dependence of Europe on the rest of the world, so far as food-stuffs were concerned, was very great.

With the rapid growth of the population, the European continent needed a progressive expansion of imports to balance its dietary needs. Generally speaking, however, the economic situation of the European countries was precarious, and such a course, for the benefit of the human potential, was not politically feasible. What happened in various countries, instead, was a progressive reduction in the volume of imports. William Vogt has said of this forced decrease of European food importations:

> Reduction in imports does not mean that the gap was being filled from European farms. It resulted, to a large extent, from a deterioration of diet. Corn, rye, and potato flour were increasingly used in attempts to arrive at national and continental self-

sufficiency. There was a considerable cut in the use of feed grains, which brought about a decrease in animal foods. This prewar trend was already preparing the way for the Spartan—or Asiatic—measures to which Europe resorted during the war.

It was following the great crisis of 1929, which rocked the economic structure of the whole western world, that the greatest reduction in the food imports of the European countries took place. "In 1933, the wheat imported into Germany, France, Italy, Poland, Sweden, and Czechoslovakia was less than one-seventh of what it had been in 1924–28," says Henry Claude in his study of the effects of this tremendous depression on the international markets. Agriculture, which had been stimulated by the First World War and supplied with important new technical resources, had registered enormous expansion in the period 1920–29, but suddenly it found itself face to face with the terrible problem of surpluses, and production that was in excess for lack of consumer markets. The world economic crisis, by creating mass unemployment had reduced internal consumption. Export opportunities were also reduced, since each country, trying to save itself from bankruptcy, put all sorts of hindrances in the way of the importation of foreign products. Then came a wave of economic nationalism, which worsened the living conditions of the poorer populations everywhere. Protective tariffs almost paralysed commercial activity. The world could find no way out of the economic asphyxiation into which it had fallen. Hunger and productive abundance existed side by side, with no one able to find a way of harmonizing the economic interests of the producers with the biological interests and needs of the consumers. It did no good to produce food, the F.A.O. *World Food Survey* found because "the world was plunged into economic depression with unemployment so widespread that consumers had to cut down their purchases of food". A World Economic Conference was called in London in 1933, but the only recommendation to receive unanimous approval was that additional restrictions on production must not be further delayed—this in spite of the demonstrated existence of universal hunger and malnutrition.

In this anguished atmosphere, with the peoples of Europe weakened and worn out with chronic hunger, Germany initiated her totalitarian food policy as a necessary step in preparation for war. The Germans had discovered the importance of food as a weapon of war during the first world conflict, when the hunger resulting from the blockade had proved the most pressing factor in their capitulation. They now planned to take advantage of the decisive years in such a way as to avoid a repetition of the collapse of 1918.

German production supplied four-fifths of the country's food needs.

The first objective of the Third Reich's food policy, therefore, was to make up the remaining fifth through internal production, and thus to achieve self-sufficiency. Toward this end, the German scientists used the most modern agricultural techniques to get a maximum return from the available land. With Ratzel's old problem of *lebensraum* again the order of the day, the greatest possible productive capacity had to be obtained from the given space. And in fact, between 1933 and 1940, Germany did increase domestic production by 15 per cent.

It was necessary, too, to anticipate the deterioration in the productive mechanism that war might bring about, and consequently to plan a rigorous food rationing system, and to build up the required reserve stocks. In planning the rationing so as not to affect the health of the population, Germany had at her disposal the whole capital of knowledge made public by the League of Nations, as well as the direct experience of her own experts.

The Third Reich set up special legislation to provide for total mobilization of food resources as early as 1933. All farmers, food processers, wholesalers and retailers were placed under the strict control of a special agency, the Reich Food State, or *Reichsnaehrstand*, which was given the job of directing the nation's Battle of Subsistence Technically, the line of defence was secured by setting up food substitute industries to make *ersatz* products, and through the psychological education of the people, who were disciplined to war rationing six years before the first shot was fired.

To set up her great food reserves, Germany proceeded to sign a series of commercial treaties with neighbouring countries which could supply her with foodstuffs, particularly those of eastern Europe. It was during this crucial period, when Germany was building up her reserves for total war, that she applied her double diplomacy of promises and threats, and succeeded in exchanging her manufactured products and industrial equipment for Hungarian, Polish, and Rumanian grain, Danish pork, and Dutch butter and cheese. By applying this suction-pump policy to food supplies in neighbouring countries, the Third Reich, between 1933 and 1939, absorbed 40 per cent of the exports of Bulgaria, Greece, Yugoslavia, Rumania, Hungary, and Turkey, whereas previously the figure had not gone beyond 15 per cent. Immediately after the occupation of the Sudetenland, in accord wth the Munich pact, the Germans "compelled the helpless Czechoslovak Government to 'sell' its grain reserves of 750,000 tons. No payment was ever made." Boris Shub said, with justice, that "the pre-war trade agreements, successful because the democracies failed to find a counter-weapon to totalitarian Germany's economic Blitzkrieg against the granaries of Middle Europe, won for the Reich the first great battle of the war".

When the war came, Germany alone had a favourable food situation, while nutritional conditions in the other continental countries, normally inadequate, grew correspondingly worse. From then on the gap became progressively wider. Germany was supplied with the spoils and confiscations of war, while her enemies were systematically robbed of their food reserves.

2

As soon as Germany invaded the various countries of Europe, she applied her policy of "organized hunger". According to Boris Shub, the master plan of the Third Reich was intended "to organize the pattern of privation for the peoples of Europe, apportioning among them in accordance with its military and political objectives the short rations which remained after Reich priorities were satisfied". Mr. Shub's impressive documentary study of these events, *Starvation over Europe*, provides many of the data that follow.

Along with racial discrimination, Germany thus established nutritional discrimination by dividing the populations of Europe into the well-fed, the under-fed, the hungry, and the starving. The Germans themselves were really the only well-fed group; all the others were to be sacrificed so that there should always be enough food for the master race. According to a statement by the Reich labour leader, Robert Ley, in 1940, "a lower race needs less room, less clothing, less food" than the German race. The collaborating peoples, who were engaged in tasks of vital or military importance for German security, received a diet that permitted them to maintain a certain degree of labour efficiency. Enemy countries were held to a régime of intense privation, so as to remove all will to resist, while certain racial groups, such as the Jews, were simply starved to death.

The Reich's "plan of organized hunger" had a solid scientific base, and well-defined objectives. Here was a powerful weapon of war, with high destructive power, which was to be used on the broadest scale and with maximum efficiency. And that is just what the Germans did, leaving aside all sentimentalism, and manipulating food supplies in keeping with the particular aims of this species of the "geopolitics of hunger", as Karl Haushofer and his clique of German geopoliticans might well have called it. "For the first time in history, food control is being used not to ensure equitable distribution of available supplies, but as a weapon of slow and certain starvation in the plan to exterminate," the Polish journalist Maria Babicka wrote in 1943.

An indispensable step toward the production of mass hunger was the confiscation of all food reserves within reach of German troops, the famous Reichswehr. One after another, the countries of Europe were sacked by the Nazis. When the Germans invaded Poland towards the end of 1939, a quarter of the country, comprising the fertile western plains, was incorporated into the Reich as the Wartelande Province. This region immediately became the great granary of Germany. During the first two years of the war, Nazi military authorities took from this area 480 thousand tons of wheat, 150 thousand of rye, 150 thousand of barley, and 80 thousand tons of oats. Some 700 thousand hogs were also collected on the plains of Wartelandia. From the rest of Poland the Reich confiscated, in 1940 alone, about 100 thousand tons of grain, 100 thousand hogs, 100 million eggs, and 20 million pounds of butter.

In April, 1940, came Norway's turn. Before the war this country had one of the highest nutritional standards in Europe; her fishing industry was one of the best in the world, and her diet was extremely rich in marine foods. Norway's merchant fleet was the third largest in the world, and when Germany invaded Poland, the Norwegians, fearing a prolonged blockade of their coasts, set about increasing imports and establishing great reserve stocks of food. Large quantities of cod and other dried fish, flour, potatoes, rice, coffee, tea, and chocolate were accumulated against possible shortages. With their domestic production—fish, milk products, eggs, vegetables and fruits—the Norwegians seemed safe from any threat of hunger. But, as Else Margrete Road related in her dramatic study of the Norwegian food situation, one day the Germans suddenly appeared, brutally invaded the country, and took possession of all these reserves. "They descended upon us like locusts and devoured everything in their way. Not only did we have three or four hundred thousand greedy Germans to feed in Norway; the German transports which brought them to us sailed back laden with Norwegian food and other goods." From them on, according to the Norwegian journalist, all these products, one after another, gradually disappeared from the market: "First eggs, then meat, wheat flour, coffee, cream, milk, chocolate, tea, canned fish, fruits and vegetables, and finally cheese and fresh fish—all disappeared down the German mouths."

Holland suffered the same fate. The Dutch government had also accumulated large food reserves to protect the welfare of the people in case of partial or even total blockade. But in May, 1940, came something much worse—the enemy invasion—and the so-called "crisis reserves" went to join the vast German food stocks. During only the first week of the occupation, the Germans in Holland confiscated some 18 million pounds of butter, 90 per cent of the country's total reserves. In the first two years of the war, a quarter of the Dutch herds disappeared, and a large part of their pastures were converted into fields for growing oleaginous crops. During this same period, the number of hogs dropped from 1,800,000 to

490,000, and the number of chickens from 33 million to only 3 million.

A basic feature of the German plan was to confiscate livestock, and to discourage all stock raising in the occupied countries, under the pretext that cattle consumed foodstuffs that should be used for man. So the Nazis carried off all the available meat, and left the bran for the enslaved populations. This is another example of the inhuman application of Germany's pretended scientific principles. According to such a theory, famished Europe could not be permitted the luxury of raising stock because the transformation of vegetable products into meat represents a waste of energy. It was necessary to follow the example of China. And so Germany planned the Sinification of Europe, that is, the corruption and degradation of European living standards to the level of the Chinese diet.

Denmark, Belgium, France, all brought their tribute to build up the great German stockpile. Some ten million dollars worth of ham, butter, and eggs were confiscated from little Denmark. As they penetrated the territories of the U.S.S.R., the Germans seized and sent back to the Reich everything that remained on the scorched earth.

The satellite countries, Germany's allies, received a treatment but little better, so far as food was concerned, than that accorded the enemy. The price their powerful friend demanded for her continued protection brought these countries to the verge of starvation. The biggest victims of this "protection" were Bulgaria, Rumania, and Hungary, which were forced to furnish foodstuffs to the Reich well beyond the limits of possible production. As Shub wrote in 1943, "The magnitude of their forced contributions to German silos and cold storage warehouses may be measured in their falling bread and meat rations; their governments are constantly reminded by Berlin that their people still eat too much to please the Reich."

In addition to monopolizing their production, the Reich made the food supply of these countries more difficult by demanding a labour supply for German factories, and thus robbing them of their agricultural workers. This labour levy was organized under Gestapo pressure, and accompanied by all sorts of tragedies. They were recalled with bitter realism by the Rumanian writer Virgil Georghiu in his terrible book, *The Twenty-Fifth Hour.*

Such was Europe, then, stripped by the Nazi grasshoppers, devastated by bombs, paralysed by panic, undermined by the fifth column as well as by administrative disorganization and corruption; and there starvation felt very much at home. Practically all the populations of Europe began a kind of concentration-camp existence. All Europe was one vast and sombre camp. And, in fact, the rationed diets of the civil populations were little different from those in the true horror camps—Bergen Belsen, or Buchenwald. These were diets of less than 1,000 calories daily, made up almost exclusively of rotten potatoes and poor quality bread.

Such extreme food scarcity gave rise to the nefarious black market, where all those who had any resources left tried to supplement their misery-rations and make them easier to bear. It is clear that these black markets usually functioned with the tacit approval or the connivance of the occupation troops, and were supplied with products diverted from their own military stores. Born of the occupation, stimulated by the Gestapo itself, the black market also represented a technique for the organized looting of the private economy of the peoples subjugated by Nazi tyranny.

Even with the black market going full blast, as it did in France, where it reached the point of robbing the Treasury of more than 50 per cent of the public revenues, the people continued to suffer terrible privations, and to exhibit, more and more clearly as the days went by, the unmistakable signs of starvation. Not long after the invasion, the rationed Polish diet dropped to 700 or 800 calories a day, and the Polish people were reduced, Babicka says, "to eating dogs, cats, and rats, and to making broth from the skin of dead animals and the bark of trees."

It is evident that the physical condition of populations on such a diet would necessarily decline to pathetic levels. Adults showed enormous loss of weight (10 per cent to 30 per cent), hunger oedemas, complete prostration and inability to work; and children suffered a veritable stagnation in their growth. A scientific mission of the F.A.O., visiting Poland soon after the war, found that children were 3 per cent to 6 per cent shorter than they had been before 1930, and that they weighed, on the average, 10 to 14 per cent less. Other manifestations of starvation in Nazi-occupied Poland were acute anaemias, goitre, and widespread rickets. At the end of the war, 70 per cent of the boys and 56 per cent of the girls showed signs of rickets, in greater or less degree.

One of the most serious results of this acute malnutrition was the loss of resistance to all sorts of infections. Tuberculosis took the reins in its teeth and, like one of the horsemen of the Apocalypse, set out to devastate the entire country. When the armed struggle ended, it was found that 80 per cent of the Polish children reacted positively to the tuberculin test, and that some 15,000 children were broadcasting germs from open tubercular lesions.

The picture of hunger in Holland, especially in the last year of the war, the winter of 1944–45, was even blacker than that in Poland. The Allies had liberated southern Holland in the Autumn of 1944, and plunged on into Germany, leaving the northern part of Holland, where the great cities of Amsterdam, Rotterdam, and The Hague are located, still under the German yoke. During this period the country's railways stopped running entirely, and nutrition reached an all-time low. The average daily diet, which had been 1,200 calories the previous year, dropped to about 800. Consumption of animal protein fell practically to zero. Total proteins varied between 10 and 15 grams a day, and consumption of fats dropped abruptly from 30 to 2½ grams.

This meant black starvation, with generalized oedemas, extreme debility, and hunger diarrhoeas. Of the classic vitamin deficiencies, conditions of vitamin A shortage were most characteristic; on the other hand, decalcification of the bones and acute anaemias were frequent. Hunger oedemas were so shockingly widespread that when this part of the country was liberated the number of sufferers was in the neighbourhood of 40,000 in Rotterdam, 30,000 in Amsterdam, 17,000 in The Hague, and 15,000 in Haarlem. And in many other cities, there were thousands of poor creatures with faces swollen and deformed by this degrading mark of hunger.

Under these circumstances the death rate, which had risen to 9 per cent in the first year of the war and to 17 per cent in the second, went up to shocking heights. According to Max Nord so many people died that, inasmuch as "timber for coffins was scarce, there were long rows of deceased to be seen in the churches".

The desperate state to which hunger had brought the populations of northern Holland during this period can be judged from the impressive photographic documents accompanying Max Nord's book, *Amsterdam During the Hunger Winter*. The introduction contains these tragic words.

> Our thoughts go back to the winter months of 1944–45 when the isolated part of Western Holland was living in bitter desperation and in the greatest need and longing for food and fuel.
>
> Here we really present the pains, sorrows and griefs of the individuals who were so desperate, hungry and frightened that they could not and did not care that there were millions of people in the world suffering in the same way. The pain caused by the death of one's own son does not lessen because millions of sons of others were killed at the same time. The paradox is that people are governed by minds and brains—they live by their hearts and souls. That is why the atomic bomb had to fall; that is why the Allied Forces marched into Germany and left us behind without food and fuel to get through a hard winter under the Germans.

The words of Max Nord are as thoroughly true as his photographs are trustworthy. His statement that millions of individuals in other parts of the world were suffering the same tortures as the Dutch is also true. The same conditions of starvation, to a greater or less degree, reigned in Belgium, in Norway, in Denmark, in Italy, in

Greece, and in other occupied countries, and everywhere there was demanded the same high and obdurate tribute in human lives.

To round out the grotesque portrait of hunger on the European continent, there remains only to add a stroke which will make the bloated visage still more sinister. This final touch is the situation of that human group which, in all the occupied countries, always suffered more from hunger than all the other oppressed groups: the Jews. Starvation was one of the Nazis' chosen means for the extermination of the Jewish people: "German scientists have, therefore, devised a plan whereby slow starvation shall eradicate the Jewish population of Europe, destroying in time all who do not perish by other means."

The harvest of death from this process was dozens of times more abundant than that from gas chambers and firing squads. The massacre of Jews during the last war was carried out, above all, by the terrible weapon of hunger, by starvation and its associated plagues and epidemics. Through certain data which Boris Shub very appropriately calls "hunger statistics", one can get an idea of what happened to the Jewish people. In the Warsaw Ghetto, during the year 1941, some 50,000 Jews perished, or a tenth of the total population—"decimation in the precise, literal sense of the word", Shub remarks. In Bohemia-Moravia, 14 per cent of the Jewish population perished in the same year. In Vienna, the Jewish death rate in 1942 was ten times the pre-war figure. These statistics give an exact idea of the tragedy of the Jews in Nazified Europe.

While the entire continent was writhing in hunger, Werner Klatt points out that the German people succeeded in holding their own nutritional standards up to 80 per cent of their pre-war level until practically the end of the struggle. Only in the last year did the German diet fall, first to 2,000 calories, and then to 1,600. And only during the last months of the fighting did it also become qualitatively deficient.

Such, in broad outline, were the nutritional conditions of Europe when the Second World War ended in 1945.

3

Among the fundamental freedoms asserted by the Atlantic Charter, signed in 1941 when the United Nations were in common struggle against Nazism, was freedom of the peoples from hunger. It was Point Three, known as "Freedom from Want". In order that this third freedom might really have effect in the critical period that would follow upon the war, the United Nations began to prepare advance plans for an adequate food supply for the countries of Europe after their liberation. At Hot Springs, in 1943, President Roosevelt called a United Nations Conference on Problems of

Food and Agriculture. Here the first seed was sown for the future international organization, the F.A.O., which was given the job of promoting a more adequate distribution of foodstuffs, and of laying down the lines of a world nutritional policy.

In the same year the United Nations Relief and Rehabilitation Agency—the UNRRA—was created, with the aim of bringing aid to victims of the war, especially in the way of food. During the war the United States, through UNRRA and Lend-lease credits, furnished foreign countries some 60 billion dollars worth of consumer goods, principally food. About 90 per cent of this aid was destined for the countries of Europe.

With the end of the conflict it became clear that conditions in Europe were tragically unfavourable to a rapid economic recovery. They quite supported, in fact, the black predictions of Lord Boyd Orr at the beginning of the war:

> When the fighting forces of the Axis Powers have been completely defeated, the United Nations will be in control of the whole world. It will be a shattered world. In some countries the political, economic and social structures will be almost completely destroyed. Even in the countries least affected by the war, they will be badly damaged. It is obvious that the world will need to be rebuilt. This affords an opportunity such as humanity has never had before of building a world in which the great advances of modern science can be applied to the development of an organization of human society which will be not only free from war, but such that mankind can rise to a level of well-being and culture higher than that dreamed of by social reformers of past ages.
>
> The opportunity will be there, but the immensity of the opportunity is equalled by the immensity of the task. The task cannot be accomplished unless the free nations which have united in the face of the common danger of Nazi world domination remain united to co-operate in building "the new and better world".
>
> It may not be easy to keep the nations united for peace aims after the last battle is won. In the flush of victory there will be a tendency for the great nations to think more of their own nationalist and imperial interests than of the contribution they can make to the common world cause.

One of the toughest post-war problems was to provide food for a Europe that had been torn and broken by six years of fighting. Several factors had led to a marked decline in food production, and now stood in the way of recovery. Particularly responsible for the decrease of food production in Europe were: a decline in productivity of the soil, due to lack of manure and fertilizers; a reduction in cultivated area; a relative scarcity of agricultural labour; and a shortage of farm tools and machinery. Acting together, in most cases, these factors had reduced agricultural production to 40 per cent below the pre-war level. This decrease had still graver effects on Europe's food balance because the population of the continent, in spite of heavy loss of life, had increased by some 20 per cent during the war.

The war was most intensely destructive to the countries of eastern Europe, but it was in the west that the problem of food shortage proved most difficult to solve. This was because of the greater density of population in this more industrialized part of Europe, and because the countries in the western part of the continent had always depended on food imports from the countries to the east. When the war was over, western Europe found itself in the gravest nutritional situation of its entire history. A few figures about basic foods will give a clear idea of the dietary poverty that desolated the region:

Comparing 1945–46 production with that of 1934–38, R. Duprat found that cereals had declined 50 per cent, meat 36 per cent, butter 30 per cent, other milk products 57 per cent, eggs 37 per cent, sugar 30 per cent, and potatoes 25 per cent. Besides, it was soon clear that western Europe could not count on the countries of eastern Europe to make up even the most serious of these shortages—because the interests of the two great powers that had seized economic control of the world, the United States of America and the Union of Soviet Socialist Republics, were opposed to commercial intercourse between the two worlds of their respective influence.

The western powers, recalling that their pre-war trade with the eastern part of the continent represented only 15 per cent of their total exports, underestimated its importance. Today, however, they recognize that the barrier to commercial exchange between the two Europes set up by the iron curtain is one of the most serious handicaps to the economic recovery of the continent. This lack of exchange was one of the reasons why the dismal famine situation of western Europe in the post-war period improved so slowly.

Before the war, the countries of eastern Europe furnished great quantities of cereals and other food products to the west, in exchange for industrial products. During the war, Germany withdrew the bulk of these foodstuffs from the east to supply her troops. Once the war was over, however, the eastern countries set out to expand their internal consumption and to raise their standard of living. Moreover, the eastern countries took exception to the fact that the Marshall Plan, which had been put into operation in the countries of western Europe, prohibited the export to eastern Europe of products classified as strategic. In reprisal, they refused to sell their agricultural products to industrial Europe. The eastern countries hold this clause in the Marshall Plan responsible for the paralysis of east-west trade.

These adverse factors created by the war were reinforced by a ruinous coincidence. The years following the peace, 1946 and 1947, brought serious weather disturbances, droughts and frosts, which damaged crops on an enormous scale. After the last battle had been won, and in spite of the really great efforts of those authorities responsible for planning rehabilitation and reconstruction, all these pressures kept Europe in the grim embrace of hunger for a long time.

The post-war phenomenon of hunger had its peculiar aspects in each part of Europe, but it was in Germany that the problem was most serious and hardest to solve. At the time that the Supreme Headquarters of the Allied Expeditionary Force was established in conquered Germany, it was assumed that by reducing consumption to the essential minimum, the German population could be supplied from local food resources. This minimum was set at about 2,000 calories a day, but the food authorities soon discovered that the country's food reserves were a long way from permitting such a nutritional level, and they were forced to cut the daily ration to 1,550 calories for the normal consumer. This restricted diet was at that time considered barely adequate to maintain health on an emergency basis, and for a period not exceeding six months. But economic contingencies forced the occupation authorities to hold the German diet to that, or an even lower level, for some three years after the end of the war.

In the second year of occupation—1946—the situation grew worse instead of improving, and in the British and American zones the average ration fell to 1,000 calories daily. In 1947, it dropped to 800 calories. To make matters worse, this diet with its overall caloric deficiency, representing only a third of ordinary physiological needs, was made up almost exclusively of bread and potatoes. There was an extreme scarcity of other nutritional substances, so that the consumption of protective foods declined to levels that were very dangerous for the health of the people. Daily consumption of proteins fell to about 28 grams, of which only 5 were of animal origin; and consumption of fats was reduced to five grams, whereas 40 to 60 grams a day are necessary for normal health. Supplies of vitamins and mineral salts were also severely limited and, as a result, a great variety of deficiencies were observed in Germany during the post-war period.

The nutritional situation became so dramatically unsatisfactory that the German people began to grumble, and to suspect that the Allies were starving them purposely, in a spirit of revenge and in accord with a plan to exterminate the German race. It was now the Germans' turn to suffer exactly the same privations they had imposed on other peoples during the war, and it was natural perhaps that they should make the same accusations against the Allies that had been made against them by the Jews, the Poles, the Yugoslavs, and other "inferior peoples" who had been subjected to the punishment of "organized hunger".

In September, 1947, the Nutrition Committee of German Doctors submitted a memorandum on the dietary situation in Germany to the Second United Nations Conference on Food and Agriculture. They offered proof of the desperate food situation and the nutritional deficiencies of the people, and made an incisive appeal to the world to put a stop to the total destruction of the German people by starvation. The document was not presented to the General Assembly of the Conference, but to the Consultative Committee on Nutrition, to which I had the honour to belong, and in it I felt the same tone of revolt, anxiety, and despair that one saw in the document prepared in 1943 by Boris Shub, in which he described the general starvation of the peoples of Europe under the domination of the German hordes. The statement of the Committee of German Doctors begins:

> The German medical profession appeals to the conscience of the world not to tolerate any longer the alarming decline of the German people's health. The majority of the German population is now living on a scale of rations amounting to not more than one-third of the minimum of food recognized by international authorities. Even the heavy worker rations, though just sufficient to keep men alive, are insufficient for the work these men are expected to perform. This existing chronic undernourishment has already produced an advanced reduction of the physical substance, and has not only extremely diminished the German's physical efficiency, but has also adversely affected his intellectual powers and altered his emotional structure. A starving man is deprived of initiative: he is irritable, hypercritical, and incapable of both constructive work and of discharging his public duties. The German medical profession raises a warning voice against the inevitable physiological consequences of chronic starvation, and the potential dangers not only to the people directly affected but also to the moral standards and the security of the rest of the world.

Then follows a description of the various manifestations of hunger rampant in Germany: hunger oedemas; debility and loss of weight, which in adults sometimes reached 40 or 50 kilos; and other symptoms and signs of the rich gamut of the "Hunger disease".

The German doctors ended their document with the following words:

> We, the German physicians, feel ourselves in duty bound to point out to the whole world that the things happening here are the very opposite to the "education for democracy" promised to us; truly, it is the destruction of democracy's biological foundation. What we are now witnessing is the destruction of the spiritual and physical substance of a great nation and nobody may disclaim responsibility unless he does everything in his power to save and help.

Thus the German doctors endorsed the people's view that the Allies planned to exterminate the defeated enemy by "organized hunger". A study of the world economic situation during the dramatic years of 1945, 1946 and 1947, nevertheless, reveals that the Allies were not in the least interested in exterminating the German race. It appears, rather, that the short rations to which the German people were subjected during this post-war period were a natural consequence of the destructiveness of war, and of the breakdown of world economy brought about by the war. Adequate food stocks were not to be found within Germany, although large-scale importations of foodstuffs from the United States, a country that had doubled its cereal production during the war years, could have set the level of food consumption safely above the hunger line. But it must be remembered that when the hostilities ended in Europe, there were other countries which had been allies rather than enemies of the United States, countries which had joined in the common fight for the liberation of Europe, and whose nutritional conditions were much worse than Germany's.

The war-devastated populations of Belgium, Holland, France, and other countries, were starving to death. It was only right that these countries should have priority over Germany in receiving what aid in the form of food North America was able to send to Europe. And under these circumstances, not much was left over for Germany. As to the worsening of the nutritional situation in 1947, this can be explained as a direct consequence of the previous year's drought, which greatly reduced the harvests not only in Germany, but in practically the whole of Europe.

It must be recognized, however, that if the Allies could do nothing at the start to combat the epidemic of hunger that the Germans let loose on the European continent, and which ended by infecting their own territory, they might still have undertaken administrative measures that would have hastened the economic recuperation of Germany and shortened the period of post-war nutritional poverty. The Allies did little or nothing in this sense.

In fact, their administrative policy in Germany, instead of ameliorating the miserable dietary situation, contributed to aggravate and needlessly prolong it. Observing the political blunders and administrative mistakes of the Allies in Germany, the American author, William Henry Chamberlain, remarked, "To the worst world war has succeeded the worst world peace." Another American writer, the war correspondent Howard K. Smith, said without pulling punches that "the story of the Allied occupation of Germany is a long, grating, complex tragedy of errors, relieved only very occasionally by any act of constructive intelligence."

Various of these errors had grim repercussions on the food situation of the Germans. The first mistake was the division of Germany into different occupation zones, functioning as closed economic compartments. In a continent that for many long years had suffered the cramping restrictions of over 30,000 miles of customs barriers, nothing could have been more harmful than to add several thousand more within Germany itself. Moreover, the dividing line between East Germany, occupied by the Russians, and West Germany, occupied by the western powers, immediately became a grave obstacle to the supply of the western part, accentuating still more its deficit of food production, as shown by the following facts.

Before the war, while agricultural production in the eastern part of the country provided a daily per capita average of 2,400 calories, production in the western part reached only 1,700. In order to make up this considerable dietary deficiency in the more industrialized zone of western Germany, the region to the east of the Oder contributed annually about a million tons of cereals, a half-million tons of potatoes, and a quarter of a million tons of sugar. These alimentary reinforcements were totally cut off by the division of Germany for occupation purposes. Moreover, the occupation of western Germany as it was initially set up, in three strips of territory administered separately by the United States, England, and France, made matters still worse, since it blocked the free flow of products within an area of multiform economic structure. The zone that suffered most in this regard was the British, including the highly industrialized Ruhr Basin, since it was the most densely populated (about 23 million inhabitants) and had the least farm production. Jean Chardonnet reported that the food production of this area did not meet more than 40 per cent of its needs, and monthly importations of 100 thousand tons were necessary to meet the minimum requirements of the population.

Another serious political error of the Allies during the first years of occupation was the plan to dismantle German industry. This involved a drastic limitation of heavy industry, forcing the country to base its economy on light industry, agriculture, and export of raw naterials. The attempt to "pastoralize" Germany, in keeping with he Morgenthau Plan, was aimed at the industrial disarmament f this warrior nation, and the development of agricultural and eace-time activities. It called for a 50 per cent reduction in erman industrial production, at the same time setting aside three illion marks' worth of exportable goods to cover importations ecessary to the life of the country.

It soon became clear that with such limitations on industrial production the German economy could not be balanced. The English were the first to feel the economic weight of maintaining their zone on such a highly distorted basis. Although 130 million pounds' worth of food had to be imported every year, the zone's reduced exportation of coal, caustic potash, and lumber brought in only 50 million. The difference of 80 million pounds had to be made up by the British government. In the American zone, while imports amounted to 50 million dollars, exports did not reach two million. Such facts were decisive in producing a modification of the erroneous policy of the excessive limitation of industry in a country as predominately industrial as Germany had always been.

The attitude of the Allied powers on agrarian policy also led to serious economic results. They refused to consider a healthful reform right at the beginning, and only carried it out on a basis of too little and too late.

The Russians, just as soon as the German troops had surrendered, set in motion a policy of land expropriation. They confiscated all properties of more than 250 acres, as well as those of Nazi leaders and war criminals. At that time more than a third of the properties in eastern Germanay contained more than 250 acres, so the law had a broad effect. The lands of 7,000 great estates, and 3,300 farms belonging to war criminals, totalling seven and a half million acres, were divided into small lots and redistributed by the Land Commissions. In this way 500 thousand new small properties of from two to twenty acres were established. The weak point of this radical and somewhat hasty land reform was the extreme subdivision of the land. Excessively small properties were set up, which those opposed to the reform said were "too large to die on and too small to live on".

In contrast with this quick action of the Russians, the western powers indulged in long and costly delays, trying to make up their minds what course to follow, and thereby greatly retarded the agricultural recovery of the region. The western powers felt that they had to play along with the political forces of the Right, in order to unite with them against the rising threat of communism in eastern Germany, and they consequently found it difficult to settle on a plan of agrarian reform. The principal argument against action was based on the fact that four-fifths of the great landed estates of Germany were concentrated in the eastern zone, occupie by the Russians; therefore there was no need to redistribute th land in the western zone. Here is what the international observe Werner Klatt, who made a profound study of food and agricultur in post-war Germany, thinks of this allied policy:

> In these circumstances the Allied authorities responsible fo western Germany were inclined to consider land reform a untimely measure likely to delay the recovery of a highly dislocated economy and an unstable society. After the event i might appear that an early decision and a clear announcemen of policy on this issue might have been more satisfactory tha years of uncertainty, but at the time the rash action of th Russians and Communists in the east tended to weaken th position of the Allies and Germans speaking in support of lan reform in the west, and to strengthen the hands of those who for one reason or another, were in favour of maintaining th *status quo*. The reform laws which grew out of this situation are not too happy compromise of widely diverging views.

It was not until a year after the Russians had carried out thei agrarian reform in eastern Germany that the Americans announce a very moderate programme. It consisted in expropriation by th State of a certain quota of the land of the great estates, varyin from 10 per cent in the case of farms of 250 acres, up to 90 per cen in the case of great estates of more than 3,550 acres. Thus th largest latifundium in the country was reduced from 12,000 acre to 1,900—which is still an enormous estate. The American reform never aimed, as did the Russian, at total expropriation of th land.

In September, 1947, the military government of the British zon promulgated its land reform, in keeping with which nobody coul own more than 375 acres of land. The agrarian reform in th French zone was also put into effect in 1947; it affected a smal number of estates with more than 375 acres. Analysing this dilator and somewhat confused agrarian policy of the Allies, a polic manifestly influenced by the more conservative parties of th Right, Werner Klatt concludes that:

> . . . the delay tactics of the extreme right wing parties in the west are as regrettable as the hasty, ill-considered reform of the Communists in the east. A realistic land policy will not do more than contribute in some way to the solution of some of the most burning problems of present-day Germany, but without it extremists will find it only too easy to tread unhindered the road to new economic and political disaster in the future.

The result of these and other accumulated errors was that the nutritional situation in Germany continued disastrous until 1949. Only then, after a monetary reform which partly corrected the worst effects of inflation, did the situation begin to work back toward normal.

Defeated Germany was not the only country where Hunger set up his European headquarters after the war. In the camp of the winners also, in allied countries entitled to reparations, nutritional conditions continued in a sad state for a long time after peace was won. The case of France is typical.

In this country, the war, the occupation, and the liberation led to extremely unfavourable conditions for food supply. France continued to go hungry for a long time after the liberation, and was shamefully preyed upon too by the corruption of the black market. The agricultural recovery of France encountered serious obstacles, outstanding among them being the extremely poor condition of her farm lands and the absolute lack of mechanized agricultural machinery.

The lack of fertilizer and a shortage of workers had contributed greatly to the degeneration of French farmland. The deficit in fertilizers reached alarming proportions; consumption of these materials absolutely essential to the life of the land fell from four million tons in 1939 to only a quarter million tons in 1945—about a sixth of the pre-war total. The decline in farm labour was also notable. According to the Ministry of Agriculture, between 1938 and 1945, 100 thousand farmers and farm workers left the land for good. In addition to this, 400 thousand farmers were made prisoner during the war, and 50 thousand were killed, leaving huge gaps in the ranks of agricultural labour. As a result of the tremendous drop in production, and the absolute lack of financial resources to buy foods outside the country, France was forced to go through long years of nutritional poverty after the war. It was only with the aid of the Marshall Plan that the country succeeded in emerging from this economic asphyxia, and that the people were able, little by little, to return to a more tolerable diet.

When the Marshall Plan comes to an end, it remains to be seen whether France can find the means within her own economic resources to maintain an adequate standard of living. It is true that her production indices have already topped pre-war levels, but it is held by some that this expansion of French industry cannot bring full economic health because of the absence of adequate economic circulation on the European continent. Such is the opinion of a group of authoritative investigators belonging to the so-called "Economics and Humanism" school:

> These production indexes do not provide an exact idea of the economic situation. They are abnormally swollen by expansion of

> power and reconstruction industries. What makes an economic situation healthy is the balance of exchange between branches and between nations, and it is with regard to this point that the present situation seems particularly difficult. The optimism of the initiators of the Marshall Plan and of the signers of the general report of the Committee of European Economic Co-operation, who believed or said they believed that a return to freedom of exchange would re-establish joint economic circulation, is today at a low ebb. Even though American aid succeeds in priming the pump, it still does not provide the piping. Inter-European exchange remains far below predictions. Exchange between Europe and the rest of the world is not balanced as regards purchase and sale. It is not that the needs of the peoples are satisfied, nor that there is a lack of merchandise, but rather that money is no longer able to play its universal role. The hard-currency countries do not understand the requirements of international solidarity, and refuse to take the risk of accepting payment in soft currencies. This is a shortsighted view, which makes it impossible to re-establish world economic equilibrium.

In the other countries of western Europe, the post-war situation has been developing in the face of the same obstacles, the same upsets and difficulties. Little seems to have come of all the efforts to achieve that coveted economic integration of the continent about which the economists, politicians and diplomats of the United Nations have talked so much, and without which a solution to the problem of regional food supply cannot, apparently, be easily found. Each country tries separately to find some saving means of escaping from the closed circle of its own privations. In the case of England, a diet has been prescribed that is narrowly limited in accordance with individual biological necessities. In the case of Holland, an attempt is being made to amplify the country's cultivated area by wresting new land from the sea. However, none of these countries has succeeded in raising its standards of living to the desired level of well-being. This is particularly true in comparison with the United States, whose high standards are the envy of the whole world.

American experience creates on all sides a kind of resentment, tempered at the same time with a germ of hope—that through *individual productivity* these same levels may be reached in other parts of the world. The most that any country of Europe has been able to accomplish so far is a precarious equilibrium—an emergency economy awaiting solutions whose shape has yet to be revealed. Holland, for instance, is planning and building gigantic dykes in the Gulf of the Zuider Zee, where extensive new polders will add 500 thousand acres of land to the country, 7 per cent of the total area of the nation. Here enough food can be raised to feed 300 thousand people. But considering that the annual population increase amounts to 100 thousand, and that the losses of the Dutch Empire in the Far East withdrew appreciable food resources from the nation, the Dutch will not win any great respite in this way.

The miracle accomplished by England in not starving to death during the war, and in attaining a certain post-war balance, is a result of the ancient experience of this island people. According to students of agricultural problems in Great Britain, the fondest dream of old-time English farmers was always a "good war". The English economist F. W. Dateson explains this aspiration as follows:

> A war could be counted on to fill the farmer's pockets. The experience of the Napoleonic Wars—when wheat rose from 40*s.* to over 120*s.* a quarter, and barley from under 20*s.* to over 60*s.*—had been amply confirmed by the World War of 1914–18. A war that was a war—as distinct from an "episode" like the Boer War—stimulated demand, while at the same time restricting supply. On the one hand, there was more money about in wartime, and people were hungrier because they were working harder; on the other hand, imported foodstuffs were scarce and expensive because of shipping risks, and British prices, undepressed by foreign competition, attained to new and exhilarating levels.

The last war filled up the bins of English agriculture, and even if it did not fill the pockets of the farmers, it served to stock the warehouses under control of the Ministry of Agriculture with great stores of food produced in the British Isles. Nevertheless, though the dietary situation is tolerable, it is far from reaching the level aimed at for the well-being of the British people.

The only hope for Old Europe, which "from an economic point of view is no more than a shadow of itself", says Chardonnet, lies in the possibility of a better understanding between the countries of the continent, and in the formation of a European Federation. At the moment, unfortunately, the profound post-war divergencies between the U.S.S.R. and the great Western powers, particularly the United States, make it impossible for this federation to embrace all the countries of Europe. There cannot really be a pan-European federation as originally imagined by the Austrian statesman Coudenhove-Kalergi, but only a federation of the countries of western Europe. And in spite of all the efforts to achieve something concrete, Europe is still a long way even from an economic union of the western nations. This is by way of being a great disappointment to public opinion in the United States, which would like to see Europe united and able to live without the assistance of Marshall Plans, which bear heavily on the American taxpayer.

The Belgian statesman Paul Henri Spaak, who has worked hard to realize the dream of a United States of Europe, has attempted to justify the relative failure of the project on grounds of the genuine difficulties placed in its way by the economic and social realities of Europe:

> In recent years it has been pointed out, in all sorts of conferences, that the prosperity of one country depends upon the prosperity of others; but it is one thing to accept this truism in principle, and another to accept the immediate consequences of putting it into practice. Europe must be rebuilt; but to rebuild Europe means, at the beginning, injuring certain legitimate interests. It may mean creating unemployment in some places for a period of time. It may mean ruin for certain individuals and certain groups. To create a new and better economic balance in Europe we must first destroy the old one. The implications of this are formidable, and those who are not aware of them or deny that they are important make the solution of the problem more difficult. Indeed, such an attitude can lead only to bitter disappointments all around.

Spaak, writing in *Foreign Affairs*, shows how long it took, how many difficulties had to be overcome, to organize a customs union of only three small European countries—Holland, Belgium, and Luxemburg—whose economies were to a certain extent complementary, into the Benelux Economic Union. Imagine the play of contradictory interests there would be among nearly twenty countries, each striving to preserve its own economic privileges, even those that are clearly harmful to the economic balance of the whole!

Thus industrialized western Europe, its economic structure visibly shaken and unbalanced by its high population density, by serious agricultural deficiencies and by shortages of raw materials for its factories, turns toward the United States in the hope that new miracles may be forthcoming for its economic survival. At the same time agricultural eastern Europe, which has swung around toward Asia and is economically linked to the sphere of influence of the Soviet Union, seeks new paths for the solution of its equally grave problems.

4

Coined by Dr. Goebbels toward the end of the war, and put into circulation by Churchill in the post-war period, the expression "Iron Curtain" has gained currency throughout the world. Wha it seeks to express is the impenetrability of the tightest frontier on earth, which divides the world into two economic hemispheres, and separates Europe into two "non-co-operative airtight compartments".

On this side of the Curtain lie the countries whose situation we have just reviewed; on the other are the popular democracies, whose political structure follows socialist lines. As already noted, these two Europes have always been very different from each other—their characteristics dissimilar, their economics complementary. Of the two, the east was always poorer and more backward. It was thoroughly impregnated with feudal agrarian traditions, which held the peasant masses in a state very similar to the bondage of medieval times. Pre-war eastern Europe in general is thus described by Howard K. Smith:

> The eastern half of Europe has been chronically impoverished, backward, and highly feudalistic in outlook and traditions—even in those parts where land reform is a generation old. Excepting Czechoslovakia and Finland, it has never known democracy, and without a large middle class or the currency of social compromise—a considerable national wealth—liberalism has not taken root among predominantly poor peasant populations.

Over these traditionally disorganized and chronically bankrupt countries war broke with a crash, causing destruction without parallel in the history of the world. The damage and losses to eastern Europe were twice as great proportionally as to those of western Europe. The bare figures can best indicate the destructiveness of the last war in this part of the world.

The greatest proportional loss of life in the war occurred in Poland and Yugoslavia, which lost 20 per cent and 17 per cent of their populations respectively. In the West, for comparison, Holland lost 2·2 per cent, France 1·5 per cent, and England ·8 per cent. Calculating per capita war destruction on the basis of the 1938 dollar, the Reparations Commission arrived at the following figures: the destruction in Poland amounted to \$2,118 per individual; in Yugoslavia, \$1,813; in the U.S.S.R., \$1,525; in Germany \$1,481; and in France, \$1,074. Of the 30 million persons who died in the war, 25 million lived in the eastern part of Europe. Two gigantic armies, German and Russian, used eastern Europe, a backward area to begin with, as a battle ground for their terrible advances and retreats, so that it is no wonder that when the conflict was over the eastern countries found themselves on the brink of an economic abyss, their economies in ruin and their surviving populations threatened with starvation.

In this atmosphere of anguish and necessity, besieged by implacable hunger and threatened with annihilation, the seven countries today dubbed satellites of Russia began to plan their economic reconstruction. The plans in all cases included agrarian reform, increased production, large-scale industrialization, and an improvement of the general standard of living. Working within the political framework of the moment, the Soviet leaders guided these countries toward a progressive collectivization of wealth.

This policy, socialist in tendency, encountered no great local resistance. The masses of the people, sacked and spoiled by agrarian feudalism and oppressive political parties, and by fascist reaction as well, hopefully welcomed the coming of a new economic era which promised them, foremost, an improvement in living conditions. It must be remembered that their living conditions, at that grim period, had fallen to the most depressed level in all the history of the region. Besides, as Lourival Fontes correctly emphasizes in the spectrum analysis which he makes of Europe in his *Men and Multitudes*, the Germans had opened up the way and facilitated the implantation of the new economic order:

> In the countries of eastern Europe the Germans were its heralds and natural allies. The occupation had destroyed private property, or carried the remains of the old order away with it as it fled. There were no more citadels to capture, no more nests of privilege to suppress, no more attempts at restoration to fear or to defy. The field of battle was left clear and untrammelled for the extension and consolidation of communist power, which was able to take up other tasks, other problems, and other incompatibilities. All energies and available forces, reserves of ability, free and recruited labour, technical instruments, resources, equipment, all and everything available was then drafted and directed in a kind of Olympian emulation to greet the dawn of socialism, the magnificent message and promise of innovation and renovation. Spread-eagle dreams, exaggerated prodigality and extravagant phantasies inspired ambition, theatricality, and megalomania. It is not arrogance and pride, however, nor megalomania, nor superfetation, but the acquisitions, progress, and accomplishments which cry out for open-mindedness on the part of the observer. The popular republics all faced the same problems and the same difficulties, and they all sought the same solutions: economic planning, intensification of industry, land reform, increased production, and the acceleration of progress. This is the positive and constructive side. And the results speak for themselves.

The central aim of this socializing policy was the elevation of living standards, and their most important aspect was nutrition. Therefore, the Socialist Republics immediately set about agrarian reform, so as to make possible a more rational utilization of the land

and a consequent increase in agricultural production. Considering the old-fashioned and inefficient methods of cultivation which had been used up to that time, this was no Utopian vision. In countries such as Bulgaria and Poland, technicians of the Food and Agriculture Organization of the United Nations projected an increase in production of 100 per cent as a goal that could be easily realized through the application of existing technical resources and materials.

As typical examples of post-war land reforms and of the results achieved, here are the cases of Hungary and Poland, countries which, as we have seen, were two great strongholds of feudal survival on the European continent.

Agrarian reform in Hungary was effected in 1945, based on a law which Leland Stowe says set forth the following specifications:

> (1)—The average farm was not to exceed 100 cadastral yokes (142 acres). (2)—Citizens of peasant descent, already on the land, might be awarded 200 cadastral yokes (284 acres). (3)—A special committee might award persons of notable anti-Nazi performance or of exceptional service in the liberation up to 300 cadastral yokes (426 acres). (4)—All original estates totalling more than 1,000 cadastral yokes (1,400 acres) were to be expropriated, and former owners could not retain more than 142 acres. Thus the law was frankly and severely discriminatory against the great landowners, whether of the aristocracy or the Church. It was intentionally designed to shear off the privileges of those who had thrived on monopoly through many generations.

By means of this reform, 8 million acres of land were redistributed. The beneficiaries were 2 million individuals who had formerly made up the rural proletariat—landless agricultural labourers. The average size of their new properties was 7 acres, although many took in less than 5—dwarf farms, too little for economical operation. Many of these small farmers began their new lives with no reserve of capital and without adequate agricultural implements. The lack of draught animals and the extreme shortage of fertilizers helped make it difficult to utilize the newly redistributed lands, so that it is not surprising that in 1946 the cultivated area of the country amounted to less than 70 per cent of its pre-war extent. The drought which ravaged the country at that time reduced the harvest proportionately more, to half the pre-war figure. This acute agrarian crisis resulted in a wave of pessimism with regard to the reform, and a few of the more defeatist small farmers sold their lands to those who were better off.

Facing this attempted reaction, the government intervened more actively than it had in rural policy, and gave more assistance to the farmer. More technical aid was provided, and farm co-operatives were organized to overcome the bad effects of excessive subdivision of the land. Such measures soon took effect, bringing about an increase in production and a corresponding increase in local consumption.

The following year—1947–48—while the food crisis of western Europe continued to be serious (there was a drop, in fact, in consumption of bread, potatoes and milk), the F.A.O. reported that levels of consumption in Hungary showed definite gains in various items, such as bread, potatoes, meat and oils. By means of a diversification of crops that has limited wheat planting to what will satisfy the internal needs of the country, and has extended production of sugar, potatoes, rice and other foods, Hungary has progressively increased production and raised the dietary standards of her people.

Poland has also achieved appreciable increases in production by means of the land reform which was begun in September, 1944. Up to the present, according to *Poland of Today*, some 850 thousand farm families have been benefited. Under the Polish agrarian programme, all properties of more than 125 acres were divided into lots averaging 12½ acres. In this way some 3 million properties were created, 3 thousand of which belong to state institutions and the rest to farmers working independently or organized in farm co-operatives.

In Hungary as well as in Poland and the other popular democracies, the co-operative movement has assumed broad proportions. To the socialist leaders it represents a transitional stage between individual private property and collectivization of the land by the state. Remembering the difficulties in their own country of convincing the farmers as to the economic advantages of collective farms, the present Soviet leaders have made no attempt to hurry the popular democracies into the collectivist stage. They consider it wiser to await the spontaneous collaboration of the rural workers, and not to force them into a régime for which they feel no enthusiasm. The upshot is a co-operative plan of production, in which the farmer takes part voluntarily. However, the economic privileges enjoyed by these co-operatives are an attraction quite sufficient to bring in the independent farmer. Toward the end of 1949, the MOSZK, or National Co-operative Centre of Hungary, controlled some 3 thousand agricultural co-operatives. In Yugoslavia, at that time, there were 3,700 such co-operatives, representing 7·8 per cent of the arable land; and in Bulgaria 1,300, representing 12 per cent of the arable land.

Through their three-year and five-year plans, the directed economies of these countries have achieved results surprising to western economists. Poland, for instance, under a plan of nationalization by which the state today monopolizes 94 per cent of the industry, 85 per cent of the wholesale and 35 per cent of the retail trade, had by 1949 been able to achieve an output 51 per cent above pre-war industrial levels. Agricultural production was up 80 per cent and national income 116 per cent. In 1948, per capita industrial production had doubled that of 1938, permitting the country to pass from a predominantly agricultural to an industrial economy. Industry accounted for only 45 per cent of production before the war, but has now gone beyond 64 per cent. The incontrovertible fact is that these countries are today enjoying an era of relative prosperity. Their working populations, both urban and rural, are beginning to have sufficient basic resources at their disposal for a decent life. An impartial observation of the evident contrast between the economic vigour and social recuperation of the Danubian and Balkan countries, and the embarrassed and hesitant economy of western Europe, led Howard K. Smith to make the following statement, of obviously transcendent political importance:

> Western Europe has fallen upon a period of social contraction; eastern Europe has fallen upon a period of social expansion. Both movements are in their earliest beginnings, but appear on all evidence to be of a long-term nature. The forces behind these movements are profounder than current politics or the Cold War. They are secular forces long accumulating and now virtually irresistible.

Mr. Smith attributes the economic rebirth of eastern Europe to various causes, among which he emphasizes the following:

> This, then, is the biggest single factor conducing to expansion in the east: the area commences its industrial revolution under those same favourable conditions that America did—with a virgin market, destined to expand rather than contract, and continental in proportions. The eastern market is even vaster than the one that provoked the rise of American industry; it extends effectively from the Chinese shores of the Pacific to the German Elbe, with not a single tariff to leap anywhere in that vast bicontinental space. This circumstance will doubtless encourage the rising industry of eastern Europe to apply standardization and mass-production techniques to a degree that has never been feasible in the national markets of western Europe.

There is no question but that this factor is highly important, particularly in comparison with the situation of western Europe, which can no longer find a market for its goods, even though its industrial production is still far short of capacity. But I have the impression that this is not the principal reason for the economic reversal of the two contrasting European areas. It is my impression that fair economic winds blow today in the East because the countries of this area, confronted with inexorable necessity, faced up to their problem and carried out a basic reform in their social structure. Without undertaking to discuss the cost to them in sacrifice, we can say that these peoples freed themselves from the innumerable privileges and prejudices which are the major obstacles to the breath of economic renovation. Western Europe, meanwhile, has been evading the necessity of facing its own economic reality, and refuses to admit that the wars and resultant crisis it has suffered are products of the grave errors of its manifestly absurd political policies. So western Europe continues stubbornly on its way, seeking its salvation in artificial economic schemes which, since they do not touch the roots of the problem, cannot effect a radical cure. The essential difference in the conduct of the two Europes is that one chose a path, rightly or wrongly, and is marching along it with confidence, while the other stands undecided at the side of the road, begging help and advice in its vicissitudes and sufferings.

Anyone who sees the world as a spatial unit cannot avoid recognizing the perils to world security which this anomalous situation presents. It is necessary and urgent that all possible steps be taken to get western Europe to come out of the absurd shell in which it is hiding. Geographic reality indicates only one procedure, that is to promote the unification of the two Europes. Howard Smith is entirely justified in making this grave judgment:

> If there is any sincerity in professions by America and Russia of aims to save Europe, the first effort of both should be to lift the Iron Curtain to permit the flow of trade and the exchange of skills and basic economic needs. Perhaps in time the politica and ideological Iron Curtain would also be raised.

To round out the study of hunger in the various regions of the world, we should by rights go on now to a final chapter dealing with the Soviet Union. But for compelling reasons, a study of thi area, which today embraces a sixth of the surface of the globe cannot be undertaken in this book.

The sheer territorial extent of the Soviet Union, its economic and social importance in the world, and still more its long history as a stage for terrible dramas of hunger, make it an obvious subject fo this study. Unfortunately, I do not have enough informative data to make an up-to-date analysis in the objective manner with which have tried to seize the existing reality in the other areas here studied.

There is a wealth of documentation on the inroads and consequences of hunger in the days of the Czars, when Russia was known throughout the world as "the country of the great famines". Sufficient data are available to judge the causes and effects of the famine after the First World War, in the early years of the Bolshevik Revolution (1921–22), and there is information about hunger during the last war, for instance, during the siege of Leningrad in 1941. There is also a great abundance of statistical data on production in the U.S.S.R., so that we have an idea of the development of agriculture. What is missing is a type of publication that would offer objective pictures of food conditions and the state of nutrition among the innumerable groups that people the various republics which today make up the Soviet Union. It is my impression that conditions vary a great deal from one area to another, and that any attempt at overall interpretation would completely falsify the particular reality of each area.

In order to avoid the kind of falsification which might result from an interpretation based on incomplete evidence, I have decided not to attempt the task. I shall not desist, however, from completing my analysis of hunger in its universal aspects, and so I shall continue to study the problem. If at some future time I find myself with sufficient material, or if it should prove possible to verify the situation in the various regions of the Soviet world directly, I promise to write a chapter, or even an entire book, devoted exclusively to the study of hunger in this area which is so much discussed and so mysterious, so feared and so bitterly opposed —and on whose political conduct depend, more and more, the peace and tranquillity of the whole world.

PART III

CHAPTER VII

THE ADVANCE AGAINST HUNGER

IN THE SECOND part of this book, I have mapped out the distribution of hunger in the world, and I have assessed the factors that govern it. In view of the evidence, collective hunger cannot possibly be called a natural phenomenon. Analysis has shown that it is caused much more by economic than by geographical factors; it is a social phenomenon which results, as a rule, from failure to make use of natural resources, or from improper distribution of consumer goods.

The fundamental truth can no longer be concealed from mankind; the world has at its disposal enough resources to provide an adequate diet for everybody, everywhere. And if many of the guests on this earth have not yet been called to the table, it is because all known civilizations, including our own, have been organized on a basis of extreme economic inequality.

The civilizations of antiquity, as Kenneth Boulding notes, "were endowed with such a limited economic surplus that they could not have continued to exist except on a basis of extreme inequality in the distribution of wealth. In the last analysis, all ancient civilizations were only small islands of culture, rising out of an immense sea of poverty and slavery". Down through history, until the great technical discoveries of modern times, it has not been possible to imagine a civilization which did not inevitably crush the majority of men into poverty.

Today, the forces of nature have been harnessed for mass production. For the first time ever, a society is possible in which poverty can be abolished, and with it, misery and hunger. The eradication of hunger is no Utopian scheme; it is a perfectly available objective. All it requires is a better adjustment of men to the lands they occupy, and a better distribution of the gifts of the land among men. That this has not come to pass is because there has been no effort to enlarge mass consumption until it corresponds to mass production, and so to balance the economy of humanity.

There is nothing quixotic about the modern fight against hunger. It is a task that follows from any cold and realistic analysis of the world's political and economic situation. Only after we have rooted out the gangrenous focuses of human misery will we be able to articulate the mass economy into which we have so avidly thrown ourselves—without taking note of the fact that we were not socially prepared for the venture.

The high levels of production on which our modern civilization is predicated demand a continuous expansion of the market. This can only come about through incorporating into the world economy the two-thirds of humanity who live on its margins. Solely by raising the buying power and consuming capacity of these people can the other third of the world survive and prosper within its present economic and social structure.

It is a pity, in these circumstances, that the struggle for better living standards does not command universal support. Many people are still taken in by the archaic and feudal notion that hunger and misery are necessary or inevitable. And many, indeed, want hunger and misery to continue because they consider the hungry and the miserable the necessary substratum for the wealth and abundance they enjoy and hold dear. Contemporary political thought clings to the false idea that economic life is some sort of game, in which some must always lose in order that others may win. The struggle for prosperity will have to begin by clearing up that misconception; the science of economics must become an instrument for the balanced distribution of the good things of the earth, so that it will never again be defined, as it was in the bitter words of Karl Marx a century ago, as "the science of human misery".

The fight against hunger is the most urgent imperative confronting us today. It is a kind of cold war, quite capable of freezing up the sources of our vitality unless we have the skill and determination to win it.

I

The first big victory over hunger will consist of a substantial gain in the world's food production. Both nature and science stand ready to co-operate in this. Great tracts of unused land lie waiting to be tilled; agricultural technology can show us how to make the best of these, as well as how to profit better from the lands now under cultivation, from the seas, and even from the synthesis of inorganic matter.

It is certainly legitimate to hope for an extension of the world's cultivated area, particularly toward the tropics and the poles. According to Robert Salter, tropical red soils, and subpolar podzols, cover approximately 28 per cent of the earth's surface, but not more than one per cent of them is cultivated at the present time.

The cultivation of tropical soils is not at all a new sort of enterprise. In the Far East, considerable areas of red soil have been in use for a long time, but the reserves in Africa and South America are practically virgin. Modern technical advances can improve the yield of lands in use, and can offer new hopes for success in tropical farming everywhere.

The surprising growth hormone, "2·4-D", for instance, can protect certain crops from the weeds which grow so fast in the tropics. Insecticides of the order of DDT., applied to broad areas of tropical savanna, could control the flies which carry cattle trypanosomes, thus making possible a vast expansion of cattle-raising in totally unexploited areas of Africa.

Toward the conquest of the subpolar lands of the Soviet Union, Canada and Alaska, modern genetics holds great promise. One of its marvels has been the development of plant varieties capable of living in the barest climatic comfort, surviving, and bearing, with a minimum of heat and sunlight. Many of these plants were, in the metaphor of the Russian writer, M. Ilin, "sent to school" to learn about life at the poles.

In the U.S.S.R., Ilin says, "the agronomist Lysenko is responsible for the suggestion of sending the plants to school. They are enrolled when they are only seeds. The school is located on a farm, and the course consists in subjecting the seeds to heat and cold, darkness and light, in certain prescribed amounts. When the course is over, the plant is sent out to the fields."

The plants have learned their lesson well. They can endure a very rigorous winter and come to bearing in a summer too short for stocks without such Spartan training. With plants educated by Mitchurin, Lysenko, and other instructors, Russia is clothing the naked Siberian steppes. Winter wheat, potatoes, cabbages and turnips are growing today above the arctic circle. Canada and Alaska, too, have stretched the limits of their agriculture into polar lands.

If, using Robert Salter's figures, we were to make use of only 20 per cent of our African and South American land reserves, some 900 million acres would be added to the world's cultivated area. Another hundred million acres could be found in Oceania. Assuming that only 10 per cent of the reserves of Russian and Canadian podzols could be farmed, another 300 millions acres would be added to the total. No one can deny that the returns from these soils are not of the highest, and they do wear out more easily than temperate soils. Still, by appropriate technical devices, particularly by turning back all residues and leftovers to replenish their fertility, such soils can be kept at reasonable levels of production, so that their use is economically justifiable. Salter asserts that with the 1,300 million-acre land increase postulated above, provided it were intelligently farmed, the whole world (including its estimated population increase) could be adequately fed by 1960.

There is certainly no lack of soil reserves for the rational expansion of food production. Even in the more fertile regions, great tracts of land go uncultivated because the economic structure is deficient in stimulating agricultural production. Cultivation has so far been limited to the most productive soils available, on the theory that while these could be had, there was no point in working the poorer areas. But once the soils of high productivity have been used to the limit, we shall be forced to go on to the intensive culture of medium and low-producing soils. The ultimate aim of agriculture, after all, is not simply the collection of exceptional profits, but rather the production of goods necessary to the collective welfare.

Soil productivity, of course, is not an absolute. Like population density, it is a variable, a function of the prevailing kind of economic organization. The soil has neither absolute productive limits—Vogt's "biotic potential"—nor absolute demographic limits. The relation of population to the soil has been handled with an inaccuracy and a blind empiricism repugnant to the scientific spirit. Earl Parker Hanson is entirely right in pointing out that: "Such neo-Malthusians as Vogt seem totally unaware that it is never a land that is overpopulated in terms of inhabitants per square mile; it is always an economy, in terms of inhabitants per square meal." To prove it, he cites the case of Brazil:

> To judge by its current low standard of living, Brazil is woefully overpopulated with 40,000,000 inhabitants. But to raise its standard of living, Brazil must diversify its economy, must industrialize, and for that it is so definitely underpopulated that the shortage of labour is one of the chief obstacles to real modernization.

Brazil provides a striking example, too, of the variability of soil productivity according to the specific agricultural practices of the given economy. In the great coffee-growing area of São Paulo, as one-crop coffee farming advanced westward across the dark soil of the uplands, many plantations were abandoned when their incomes dropped sharply due to the exhaustion of the soil. Coffee monoculture, in a nomadic search for richer earth, apparently ruined vast areas of fertile Brazilian land; and left it quite useless. Some Japanese immigrants bought these lands for nearly nothing. They put their long experience with thankless soils to work, and through a Farm Co-operative Organization developed the cultivation of potatoes and vegetables. A magnificent green belt has thus grown up around the state capital, contributing so much to the food supply of this city of two million that its nutritional standards have been markedly improved.

That story of restoration bears out the contentions of Edward H Faulkner, an agricultural revolutionary, who denies that thousands of years of tedious natural processes are necessary to replenish depleted soils. He insists that man himself can restore eroded soils be relatively simple technical processes:

> We can recreate good soil wherever good soil formerly existed, and we can do so by machinery. . . . For the whole category of areas that have suffered merely water erosion, however severe, there is still definite assurance that as good soil as ever existed upon them can be restored. Much the same can be said of areas damaged by wind erosion, or by excessive cropping and grazing.

Orthodox soil scientists and agricultural experts consider Faulkner a heretic and a visionary, who thinks that his methods will multiply agricultural production to five or ten times its present size. But Faulkner has quite a lot of evidence in his favour. A further example is that of the Dutch, who have succeeded in making new agricultural soils out of the beds of the shallow seas that surround them. If it is possible to *create* new soils where none existed, it should be much easier to *re-create* exhausted soils, or to build up those unadapted to agriculture. There ought to be less difficulty in correcting deficiencies than in constructing soil in the first place. One is forced to the conclusion that what may be worn-out or unusable soil within the limitations of one type of agrarian economy could well be made use of under other conditions. With a little work and economic investment, the land can be restored.

2

Our territorial frontier, then, takes in the poles, the tropics, the depleted and even the submerged lands of the globe. But expansion is not the only way to bring about a large-scale increase in our food supply. We can raise the production per acre of our currently cultivated land. Certain countries have shown recently, particularly during the war, that an appreciable increase in "the agricultural output per unit" is indubitably possible everywhere, through the application of technological improvements within the reach of contemporary science.

Such optimists as Colin Clark, indeed, go so far as to say that there is no need to bring new lands under cultivation, that enough could be produced by scientific management of those already in use:

> We have shown above that world population may be expected to increase at the rate of 1 per cent per annum, while improvements in the technique of agriculture may be expected to raise output per man-year at the rate of 1½ per cent per annum (or 2 per cent per annum in some countries). Any profound

> Malthusian pessimism is thereby completely discredited—scientific improvements alone are capable of taking care of the increase of world populations, without necessarily bringing any additional land into cultivation.

I think we cannot afford to be quite so sanguine as to overlook the potentialities of new territory. The ratio of production to consumption must be considerably increased. But science, certainly, has given us a formidable array of techniques to apply to *all* our agricultural concerns, old and new. Such technical broadsides, effected by means of overall planning, are the central characteristic of our time; they represent a second industrial revolution. While the industrial revolution of the past century applied mechanics to manufacturing, the contemporary revolution applies scientific methods to all sorts of enterprise. It involves, in short, the widest application of science to all the problems of production.

Research has found us several sorts of new techniques to increase the productivity of the soil. There are the measures for the care of the soil itself; the increased use of lime, fertilizers and cover crops, and of generally better methods of soil conservation. Then there are the botanical developments which have brought about the widespread use of such high-yielding varieties as hybrid corn, and of superior, disease-resistant strains of oats, soybeans, potatoes and other crops. In livestock-raising, both breeds and feeding have been improved upon. And, finally, science has found new and effective ways of controlling plant pests and diseases.

Making use of these discoveries, the United States has been able to "increase the productivity of farms more than one-third on the same acreage" in the last fifteen years. Bruce Bliven says that "Food crops have been increased by 40 per cent." R. P. Christensen points out that "Crop production per acre was about 20 per cent higher and livestock production per animal unit of breeding stock was nearly 10 per cent higher during the war years than before the war."

The U.S. Bureau of Agricultural Economics reports in *Freedom from Want* that "during the 5 crop years beginning with 1942 our farmers produced enough food each year to nourish approximately 50,000,000 more people than could have been fed at comparable dietary levels from our national production during the last 5 years of the 1930's. This job was done with 10 per cent fewer workers. Some of this larger production was due to favourable weather, but by far the larger part can be credited to technological advances due to science." England, Denmark, New Zealand, the U.S.S.R., and other countries also obtained huge increases in productivity through the application of technological improvements to agriculture.

Any discussion of technological progress almost inevitably brings to mind the problem of modern man's distance from the natural world. Clearly, one result of modern agricultural technique has been that even the farmer, in a progressive agrarian setup, is not so intimately connected with nature as his predecessors were. It is obvious that such an estrangement must have its spiritual consequences; what is more relevant to this study is the material loss or gain that may be due this altered relationship.

There are those who hold that the promiscuous use of technical methods ultimately weakens, rather than strengthens, agricultural productivity. One particularly vexed technical question which I should like to examine turns on the use of fertilizers. This specific technique has provoked a great deal of debate about the place of laboratory techniques in agriculture, thus illuminating a wider problem.

Western agriculture relies heavily on the use of artificial fertilizers. The first point at issue is whether there are available in the world sufficient reserves of these corrective chemical elements. The second question is whether the use of fertilizers, admitting that it increases production in a quantatitive sense, does not have a negative effect on the quality—whether there may not be a decline in nutritive value when fertilizer is used on a large scale.

The use of artificial fertilizers is limited to a certain number of countries, but the amount of these materials needed to maintain present world agricultural production has already reached tremendous proportions. The United States alone, to maintain food production during the war, made use of an annual average of some 12 million tons of fertilizers, costing approximately 400 million dollars. If the world's cultivated areas are to be increased by 1,300 million acres of new soils, and if the present rate of use of artificial fertilizers per acre is continued, Robert Salter calculates that 8 times the present quantity of phosphates will be needed, and 18 times the present consumption of potash. Does the world possess enough reserves of these elements for use on such a scale? Or will Nature turn out to be niggardly in this respect, and so sabotage humanity's plans for expansion?

Let us see what Salter himself has to say on this point: "Even so, the known world reserves of phosphates would last more than 5,000 years and the known reserves of potash 500 years. The world has not been thoroughly explored for these minerals. Doubtless actual reserves exceed known reserves greatly." So there would seem to be no question as to the availability in nature of sufficient chemical fertilizers.

The picture is not so reassuring, however, with regard to their efficiency in maintaining soil health or in keeping up the nutritive quality of products and the health of the populations that consume them. There are some scientists like Dr. E. L. Bishop, Health Director of T.V.A., who look upon the use of artificial fertilizers as the most economical way of providing a constant restoration of soil fertility and a progressive improvement in human nutrition. But there are others, such as the English scientist, the late Sir Albert Howard, who regard the use of these artificial products as a veritable assault by civilization against the health of soils, plants and men.

Howard's theory rests on the premise that synthetic fertilizers are a long way from furnishing soil with all the elements necessary to its complete restoration. This can only be accomplished by the use of natural manures, and of agricultural methods more natural than those proposed by scientific western agriculture. Howard calls attention to the contrast between western farming methods and the processes that nature uses to keep the soil in living, healthy condition:

> What are the main principles underlying Nature's agriculture? These can most easily be seen in operation in our woods and forests. Mixed farming is the rule; plants are always found with animals: many species of plants and animals all live together. In the forest every form of animal life, from mammals to the simplest invertebrates, occurs. The vegetable kingdom exhibits a similar range: there is never any attempt at monoculture: mixed crops and mixed farming are the rule . . .

And Howard insists:

> The main characteristic of Nature's farming can therefore be summed up in a few words. Mother earth never attempts to farm without livestock; she always raises mixed crops; great pains are taken to preserve the soil and to prevent erosion; the mixed vegetable and animal wastes are converted into humus; there is no waste; the processes of growth and the processes of decay balance one another; ample provision is made to maintain large reserves of fertility; the greatest care is taken to store the rainfall; both plants and animals are left to protect themselves against disease.

Howard goes on to accuse western agriculture of being extremely anti-nature, what with machines replacing animals, one-crop farming in the saddle everywhere, and the use of artificial fertilizers becoming more general all the time. The great English agriculturalist says of artificial fertilizers:

> Artificial manures are widely used. The feature of the manuring of the west is the use of artificial manures. The factories engaged

> during the Great War in the fixation of atmospheric nitrogen for the manufacture of explosives had to find other markets, the use of nitrogenous fertilizers in agriculture increased, until today the majority of farmers and market gardeners base their manurial programme on the cheapest forms of nitrogen (N), phosphorus (P), and potassium (K) on the market. What may be conveniently described as the N.P.K. mentality dominates farming alike in the experimental stations and the countryside. Vested interests, entrenched in time of national emergency, have gained a stranglehold. Artificial manures involve less labour and less trouble than farmyard manure. The tractor is superior to the horse in power and in speed of work; it needs no food and no expensive care during its long hours of rest. These two agencies have made it easier to run a farm. A satisfactory profit and loss account has been obtained. For the moment farming has been made to pay. But there is another side to this picture. These chemicals and these machines can do nothing to keep the soil in good heart. By their use the processes of growth can never be balanced by the processes of decay. All that they can accomplish is the transfer of the soil's capital to current account. That this is so will be much clearer when the attempts now being made to farm without any animals at all march to their inevitable failure. Diseases are on the increase. With the spread of artificial fertilizers and the exhaustion of the original supplies of humus, carried by every fertile soil, there has been a corresponding increase in the diseases of crops and of the animals which feed on them. If the spread of foot-and-mouth disease in Europe and its comparative insignificance among well fed animals in the East are compared, or if the comparison is made between certain areas in Europe, the conclusion is inevitable that there must be an intimate connexion between faulty methods of agriculture and animal disease. In crops like potatoes and fruit, the use of the poison spray has closely followed the reduction in the supplies of farm-yard manure and the diminution of fertility.

For Howard, the fertilizing practice that has developed out of Liebig's studies in chemistry "is based on a complete misconception of plant nutrition. It is superficial and fundamentally unsound. It takes no account of the life of the soil, including the mycorrhizal association—the living fungus bridge which connects soil and sap. Artificial manures lead inevitably to artificial nutrition, artificial food, artificial animals, and finally to artificial men and women".

Salvation might be found, according to Howard, in a return to more natural farming methods, particularly in the use of natural manures obtained from various sorts of organic matter, such as "the roots of crops, weeds, and crop residues which are turned under in the course of cultivation; the algae met with in the surface soil; the turf of worn-out grass land, catch crops, and green-manures; the urine of animals; farmyard manure; the contents of the dustbins of our cities and towns; certain factory wastes which result from the processing of agricultural produce; the wastes of the urban population; water-weeds, including seaweed."

On the strength of his long agricultural experience in India, Howard recommended and publicized the "Indore Process," which consists of composting animal and vegetable residues together with a chemical base which neutralizes their acidity. In a series of memorable experiments, he demonstrated that plants cultivated by his process were immune to innumerable pests and plagues, and that the animals which ate them also showed surprising resistance to various epizootic diseases common in the Far East. In a speech delivered in Cheshire in 1939, on the occasion of the reading of the famous Medical Testament which has been discussed in Chapter VI, Sir Albert Howard is cited by L. J. Picton as declaring that nature and the peasants of India, in collaboration with the insects and fungi which he called "nature's own professors of agriculture," had taught people "how to grow healthy crops practically free from disease without any help from mycologists, entomologists, bacteriologists, agricultural chemists, statisticians, clearing-houses of information, artificial manures, spraying machines, insecticides, fungicides, germicides, and all the other expensive paraphernalia of the modern experiment station."

Howard was without question an iconoclast whose overriding mental rebellion led him to deny categorically any and all value to modern agricultural technique. But there is undoubtedly a lot of truth in much of what he says. He is supported by certain objective facts.

On the one hand we have seen Chinese agriculture, based on the use of natural manures, endure for 40 centuries without any demonstrable exhaustion of soil fertility. On the other we see how the United States of America, using fertilizers on a scale without precedent in the history of agriculture, has already exhausted 100 million acres of land in less than two centuries of cultivation. The living experience of China is a good antidote to the excessive enthusiasm of those who study agriculture in laboratories, forgetting that the natural habitat of plants is not a test tube, but the bed of earth itself.

With the idea of making this Eastern experience available to the West, the American specialist F. H. King proposed to write a "Message of China and Japan to the World," to be added to his great book, *Farmers of Forty Centuries*. Death, unfortunately, interrupted the preparation of this message, but from the finished portion the following significant passage has been published by G. T. Lorench:

> It could not be other than a matter of the highest industrial, educational and social importance to any nation, if it could be furnished with a full and accurate account of all those conditions which have made it possible for such dense populations to be maintained upon the products of the Chinese, Korean and Japanese soils. Many of the steps, phases and practices through which this evolution has passed are irrecoverably buried in the past, but such remarkable maintenance attained centuries ago and projected into the present with little apparent decadence merits the most profound study. Living as we do in the morning of a century of transition from isolated to cosmopolitan national life, when profound readjustments, industrial, educative, and social, must result, such an investigation cannot be made too soon.

The fact of the matter is that western technique has a great deal to offer toward improving living conditions in the Orient, but at the same time, the Orient also has weighty contributions to make to the human economy of the West. One of the most valuable of these contributions is the doctrine taught by the creator of the Indore Process. We really do not yet have sufficient data to tell whether the nutritive value of foods produced on artificially fertilized soils is or is not equal to that of foods grown on soils naturally rich in humus, or restored with natural manure. But the facts seem to indicate that foods grown on artificially fertilized soils lack something or other of their full nutritional value. Howard is very sure that:

> . . . the verdict given by mother earth between humus made with animal residues and humus made with chemical activators like calcium cyanamide and the various salts of ammonia has always been in favour of the former. One has only to feel and smell a handful of compost made by these two methods to understand the plant's preference for humus made with animal residues. The one is soft to the feel with the smell of rich woodland earth: the other is often harsh to the touch with a sour odour. Sometimes when the two samples of humus made from similar vegetable wastes are analysed, the better report is obtained by the compost made with chemical activators. When, however, they are applied to the soil the plant speedily reverses the verdict of the laboratory.

It is reasonable to conclude that artificial fertilizers cannot restore soils completely, although they can be of inestimable service in making up some of the chief deficiencies. It is my opinion, however, that present-day fertilizers need a great deal more study before they are completely satisfactory. The science of soils is still far from coming of age; it is in just about the same situation as nutritional science at the beginning of our century, before vitamins were discovered.

At that time, the science of nutrition was satisfied that the human body could be kept in balance with nothing more than sufficient doses of building materials and energy. When this principle was applied, however, by feeding chemically balanced synthetic rations to animals, it was found that all-round nutrition required something else again—something not to be found in a ration of synthetic proteins, carbohydrates, fats, and mineral salts. The missing ingredient—"X"—later came to be identified as the vitamins.

Something of the same sort must be wrong with the attempt to nourish soils with the mere mineral salts of artificial fertilizers. There is something about the process of vegetable nutrition that requires the presence of organic matter in the soil. Moreover, plant life does not depend simply on the chemical composition of the soil; there is also the question of its physical structure. With tropical soils, in fact, this is the most important factor. The agronomist Meinaert, with his broad experience of tropical African soils, always insisted that the ability of such soils to produce is a result of their physical make-up rather than of their richness in specified chemicals.

The colloidal complex is the prime element of soil fertility, as well as the greatest guarantee of its aeration and water-absorbing ability. From this fact follows the fundamental importance of conserving the soils' supply of humus. Without humus the plant can sprout, grow, and bear, but something is missing in its life, just as it is in the lives of artificially-fed laboratory rats. Rats and plants so nourished easily fall sick and die for lack of natural resistance. Nobody has yet succeeded in keeping animals alive and healthy with exclusively synthetic food, and that miracle appears to be equally difficult with plants.

We can learn from the opposing views of western agricultural experts on the one hand and the followers of Howard on the other, that it is not only possible but necessary to combine the old methods and experience with the new. A combination of the practices preached by the two groups offers, perhaps, an ideal way to renew without destroying, to increase the quantity of production without permitting a qualitative decline in nutritive value.

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Such a scientist as Fabre, who could lie on the ground for whole days at a time to watch the ways of ants and other insects, is a real rarity in modern life. The naturalist of today is little interested in how living things live, but rather in their behaviour under complicated laboratory tests and their appearance, killed and quartered, under his powerful microscope. Yet it is certain that renewed exploration in the immense preserve of nature, carried out with love and patience, would reward us with new food resources whose existence we do not even suspect.

The domestication of plants and animals must have required a ong and intimate contact, an intense sympathy on the part of man or those other living beings, and a patient observation of the habits of the plants and animals to be adopted. Such attitudes are not much esteemed these days. There have been no modern achievements in his field; in fact, nearly all the plants cultivated today were domesticated in pre-historic times. Our failure to explore such possibilities is one instance of man's withdrawal from nature, his solation behind his cultural bastions.

A beginning has been made, very recently, toward this kind of eapproximation of man and nature. Returning to an almost lost radition, bio-chemists and students of nutrition have begun to study he nutritive potentialities of wild plants. They have found several pecies which could be of excellent use to man.

Only lately, studies at the Massachusetts Institute of Technology evealed "a vast untapped food reserve" in the native flora of Central America. Upon examining some 200 specimens of regional oods in that part of the continent, the M.I.T. experts found that several were extremely rich in mineral salts and vitamins.

At the Institute of Nutrition of the University of Brazil, we have discovered, in the semi-arid zone of the Brazilian north-east, plants which constitute the most abundant sources of calcium and vitamin A in the whole world. The remarkable source of calcium thus brought to light is a bromeliaceaous plant (Bromelia laciniosa, Mart). It can be made into a meal which contains fifteen times as much calcium as milk.

The new source of vitamin A is the oil of a palm, the *buriti* (Mauritia Flexuosa, Mart), which contains five thousand units of this vitamin per cubic centimetre. If such plants as these were cultivated on any appreciable scale, we would indeed have an arsenal of essential nutritive principles to arm us against specific hunger.

It is not only on land that new resources for human nutrition might be found. There is the great domination of the waters—oceans, lakes, and rivers—whose spectacular richness in food products has been very little explored. No accurate statistics exist as to the world's catch of fish, but the approximate calculations of the F.A.O. show a total of some 10 million tons. This represents less than one per cent of world food production. Considering the world's fish reserves, various experts assert that such a figure is ridiculous, and could be increased dozens of times over by an efficient organization of fishing methods. And although some countries, such as Japan, the United States, Norway, the U.S.S.R. and the United Kingdom, utilize marine foods in appreciable quantities, many other countries, especially in the Southern Hemisphere, pay not the slightest attention to this precious and inexhaustible source of the most biologically valuable foods.

Modern technique makes possible some very high returns from raising fish, molluscs, and crustaceans in hatcheries or artificial ponds, both fresh and salt. According to Bruce Bliven, raising these animals on organic residues and leftovers, as is done in China, produces a "larger return than does the land itself used in the more orthodox way." The use of growth hormones, artificial fecundation, the sowing of manure in fish tanks to add nourishment to the water, are methods that could be perfectly well be used to multiply food returns from the water many times over. Blegvad has pointed out that "modern fishing is becoming more and more a kind of marine agriculture." Water farming offers as high returns as land farming.

Water offers possibilities, too, for cultivating plants. There are scientists who claim that even if all our soil reserves were gone, we could continue to feed ourselves by soilless culture. Following the studies of Dr. Gericke, relatively successful attempts have been made to carry on agriculture in water enriched with the nutritive materials essential to plant life. During the war, American occupation troops on some of the sterile islands such as Ascension and Iwo Jima grew enough food in water to give great hope to the inventors of hydroponic cultivation.

The seas hold still more abundance for us. It has been some time now since scientists called attention to the spectacular richness ir minerals and vitamins of certain microscopic vegetables and animal that form the marine plankton. Plankton, suspended in the water serves as food for larger animals, but only recently has the possibilit been raised of using it as a source of human food. The most promising kind to be found so far is a green alga, the *chlorella*, which could b grown in huge tanks on minerals and a common gas, and whic Nat Finney says would furnish "many times as much basic foo as . . . an acre of our best soil". By feeding this alga to anothe living creature, the yeast cell, a chain of food production could b set up like the one farmers establish when they feed their corn t hogs, in order to transform the carbohydrates of corn into pork an lard.

Thus Dr. Richard Meyer and his collaborators have developed new source of proteins and fats. Its possibilities are virtually unlimited. With this new food team, chlorella and yeast, food technologists hope to revolutionize world nutrition, and to put an end t protein and fat deficiencies for all humanity. Toward this end, the plan the construction of huge industrial plants to carry out the rational food production chain that begins with the chlorella. A single such factory could produce enough proteins to feed 3 million people, and enough fats for 1½ million, giving humanity, according to Dr. Meyer's calculations, the equivalent of about 150 thousand acres of good arable land.

Some synthetic foods are beyond the planning stage. Proteins are actually being produced today by means of a ferment, torula yeast, which is fed on molasses. A factory, operating on the technical principles of the English scientist A. C. Thayson, has been set up in Jamaica. It currently turns out five tons of proteins a day, at economically competitive prices. Still more revolutionary is the manufacture of synthetic fats by the "Fisher Tropsch Process" of oil synthesis. German factories reached an average production of 10,000 tons of fats a year by this method during the war. Experts of the Nutrition Division, F.A.O., make the following comment on this successful attempt to obtain food energy from inorganic substances:

> For the first time in history it is now possible to synthesize from nonbiological and even from inorganic materials a food of calorific value. This, in itself, is extremely significant and revolutionary. It would, however, clearly be premature to advocate the large-scale manufacture of synthetic fats for human consumption, pending the collection of more complete and satisfactory experimental and clinical data. At the present time the cost of synthetic fats is higher than that of natural fats, but this is not necessarily a deterrent. New processes are always expensive, and their cost is gradually reduced as industrial research progresses. Since Germany is short of fats, it would be advantageous to encourage the manufacture of synthetic fats in that country for industrial purposes. At the same time, further experimental work on the subject should be vigorously developed.

Such are a few of the more striking possibilities which science has placed at the disposal of humanity. One point is beyond all doubt. By the application of rational agricultural methods and by an increase in the cultivated area, it is fully possible to satisfy the nutritional needs of the world's growing population. If the fruitful cultivation of our poorer or more remote soils should, like the synthesis of fats, prove initially expensive, this should not be considered an impassable barrier; it ought to be thought of as a difficulty that can be overcome by reorganizing the economic apparatus, taking into account the necessity of paying prices high enough to warrant the production achieved.

A few years ago, when artificial fungus cultivation was begun in order to obtain antibiotics such as penicillin, aureomycin and terramycin, the cost to the process was found to be very high, but the project was not abandoned on that account. The antibiotics were magnificently efficient in combating innumerable infectious diseases, and their cost was not prohibitive in view of the benefits.

Now, it is a demonstrable fact that food is the most potent of all the antibiotics, since it protects the organism in a general way against all kinds of germ attack. If the world had a well-balanced diet, we would have little need for specific antibiotics or other drugs. This line of thought is the foundation for the statesmanlike view of those who join E. B. Balfour in looking at agriculture as a kind of medical necessity:

> Once agriculture came to be regarded as a health service, the only consideration in any matter concerning the production of food would be: "Is it necessary for the health of the people?"; that of ordinary economics would take quite a second place.

When deserts of ice and impenetrable tropical jungles are being turned to gardens and orchards, when the lands we farm and the plants we grow are being made to multiply their yield, and while we are barely learning how to tap the great food reservoirs of the waters, the wild flora, and of artificial synthesis, the Malthusians go on setting up their sinister scarecrows. It is nothing to us, since we have no reason to fear them.

CHAPTER VIII

GEOGRAPHY OF ABUNDANCE

No DOUBT REMAINS that science and technique can play a decisive part in solving the problem of hunger. Production of foodstuffs can be increased to the point of satisfying fully the nutritional needs of all the human race. And the possible contribution of science would be greater still if students of biological problems had only received more stimulus and support from the ruling circles of our time.

The fact is that our mechanistic and utilitarian civilization has always relegated the biological sciences to a secondary plane. Major attention has been concentrated on the production of wealth; much more thought has been given to physical and chemical research than to the field of biology. The disparity between the successes achieved is apparent to all. The English scientist Julian uxley has said that world statistics show that there has been five r six times as much research in physics as in the biological sciences.

It must not be forgotten that men of science can work only if they re paid. They eat, dress, and have families like common mortals. nd it so happens that these scientists get on a payroll only when heir labours are of interest to somebody, whether it be an individual, n industry, or a government. Now governments, institutions, and mployers, during the last century of western culture, have been xcessively absorbed in problems of economic exploitation, and ave in general shown no great interest in human problems as such. an was treated as hardly more than an element of production, cog in the economic machine. That is why there are a great many ore paying positions for physicists and chemists than biologists.

Physical and chemical research are of prime utility to the commerce nd industry that finance them, while health, which is served by iological research, pays no direct dividends. An English observer otes that in one industrial research laboratory alone—that of he Imperial Chemical Industries—the number of technicians orking out new advances in the field of chemistry, in 1940, was good deal larger than the total number of research biologists in e whole British Empire. It is obvious that the industrial chemists, ith their larger numbers, better pay, and better equipment, are a more favourable position to make discoveries and to hasten e progress of their science, than the thin ranks of biologists, who re left to their narrowly personal enthusiasms and to their strange ttachment to the study of problems that the leading elements of e world in general care little about.

Nevertheless, even with our limited knowledge of phenomena in e living world—with the present resources of agro-biological ience—it would still be possible to carry out a veritable revolution the field of food production. It would be possible, that is, except r the opposition of certain economic and political forces which and in the way of large-scale application of scientific knowledge. hitney Cross has commented sharply on the way social reality lds back the application of science to agriculture:

> Obviously, we know how to get more food. We can restore forests where they will resuscitate sterile slopes and regulate water flow. We can retain the fertility of our good soils and even slowly increase it. We can get more pork from every hog and more corn off every stalk. We can learn to irrigate rich arid lands without ruining them. We can even see looming ahead more daring ventures for bigger stakes (and more stakes), as increasing knowledge will permit present hints to become real potentialities. We may predigest and render edible the grasses, or even the trees, which can be grown on poorer soils; or shoot off

dry ice in the clouds to make it rain where we need moisture instead of where we have too much; or apply radioactive or other charges to soils or plants to stimulate growth; or devise means to restore soil life more quickly through bacteriology and chemistry; or utilize more sea resources or raise lands out of the oceans; or solve some of the difficulties of tropic and arctic agriculture. Cheaper, more abundant energy from nuclear fission may make economically feasible developments which now seem impossible.

All such prospects, however, depend on an immense if. We have to reckon with human cussedness. Suppose scientists learn all the answers. How can the world's farmers, a numerous and ignorant lot, possibly be educated in time? And how can the world's industrialists, a selfish lot when not also ignorant, be pushed into line? This is the crux of the problem. This is where the whole question of conservation descends from the utopia of science to the earthy level of human policy.

Up against politics, the problem of overcoming hunger passes out of the hands of technicians and men of science. Dr. Vannevar Bush expressed it very well at a meeting called by the Massachusetts Institute of Technology to discuss the "Social Implications of Scientific Progress in the Mid-Century." He said that agricultural science has gone forward with such impressive speed that we may soon be able to synthesize chlorophyll itself, the creative element that generates food under the action of solar energy. This promises to open up possibilities for humanity equal to or even greater than the application of atomic energy. And there is no shortage o natural or technical resources to carry out the task. The problem Dr. Bush emphasized, "is how to apply the advances made by physical scientists under the conditions existing in the real world This is a task not for physical but for social scientists, and fo political practitioners."

The point is that it is not enough simply to put all this techniqu to work producing food; the food must, in addition, be acquire and consumed by the human groups that need it. If there is n adequate distribution, no increased consumption, there will soo be agricultural surpluses, and we will be faced with the doubl problem of overproduction and underconsumption. An effectiv food policy must look to distribution as much as to productio and it must be planned on a world scale. As Frank Boudreau ha said:

> If the advance in science is to prove a blessing and not curse to mankind, we must think in *world terms* and build up fo our world the social, economic and political institutions whic

will set mankind on the road to freedom from the misery, want, disease and premature death which have been man's companions for so many centuries.

What with customs barriers, antagonistic economic blocs, policies of agricultural nationalism and economic autarchy, an international balance of food consumption will be an arduous achievement.

All these restrictive measures are due to differences in the productive levels of various regions of the world. Hunger itself, in the ast analysis, is the result of low levels of individual productivity. The peoples or groups who go hungry are always peoples or groups of strikingly low productive capacity, and it is their scant productivity which prevents them from acquiring the foods necessary to a balanced diet.

I

To wipe out hunger, then, it is necessary to raise the productive evels of marginal peoples and groups, and through economic progress to integrate them into the world economic community. Such raising of productive levels depends on very many factors, he most important of which, no doubt, is the type of economic rganization in which the individuals take part. Certain kinds of conomic exploitation invariably impose infra-human levels of productivity, far short of normal, minimum necessities. So long as these types of economic exploitation continue, hunger will continue o haunt our civilization, in spite of all our efforts.

The so-called "colonial economy," under which the industrial owers get their raw materials at low cost and on this basis enjoy marked prosperity, is one kind of economic exploitation that is ncompatible with world economic balance. As we have seen in revious chapters, the world's great areas of endemic hunger are xactly the colonial areas. They may be political colonies, such as he territories of Africa, or they may be economic colonies like hina or the greater part of Latin America, dedicated as it is to he production of raw materials to feed the industries of Europe nd the United States.

Without a basic change in colonial policy, which would permit he colonial peoples to produce on a scale sufficient to satisfy their iological needs, there is no use hoping for a radical solution to the roblem of universal hunger. Colonial peoples will go hungry just o long as they dedicate their best efforts to producing raw materials r export, because the play of world economic forces always tends o reduce the value of their labour in the interest of industrial rofits. I should like to give a few examples of the greatly inferior cquisitive capacity of peoples in colonial situations. I shall take these examples, not from true political colonies, but from politically independent countries which continue to labour under a colonial economic structure.

Cuba is one of the world's greatest sugar producers, yet a Cuban factory worker can buy, with his day's wages, only a quarter as much sugar as an average factory worker in the United States can buy with his daily wage, according to an investigation carried out during the last war by technicians of the National Planning Association, of Washington, D.C. A factory worker in Colombia has to work four hours to buy an amount of coffee corresponding to one hour's work in the United States—and Colombia is one of the leading coffee-producing countries. These and other colonial peoples have built their economies around one or two export products whose prices are always fixed by users in the mother country. At the same time, they have had to import an infinity of industrial products at prices also set by the mother country. As a result, the people have remained sunk in poverty. Only by freeing themselves from the colonial system can these hunger areas develop enough production to live on. They can do this not only by diversifying production, but also by setting a fair price for raw materials and by working them up locally.

The problem cannot be solved by increasing individual productivity alone, and so expanding the production of certain products. The article produced must be valued in keeping with the needs of the producers. This means that the prices of raw materials canno forever be set on the basis of profit margins, through the play o competition for industrial products. They must be related to the cost of basic local necessities in the groups producing raw materials A French economist of the "Economics and Humanism" schoo is entirely right in calling attention to the dangers and disillusionmen inherent in the belief that everything can be solved by a simpl increase in productivity. Productivity is no doubt the key to th problem, but it must be approached in terms of humanisti economics.

A case in point is that of Venezuela, where petroleum productio per capita is among the highest in the world. But production oil and nothing else has led to inflation of prices; that nomina wages are high, giving an impression of high individual productivity doesn't prevent the country from being one of the great hunge spots of the world. Before the petroleum dynasty was establishe the people of Venezuela produced meat and corn, and fed themselves reasonably well. Today, however, Ricardo Ortiz says th to keep the population from starving, it is necessary to impo annually 200,000 tons of meat, 1,000,000 tons of milk, 50,000 to of cheese, 50,000 of butter, 200,000 of garden crops, 75,000 of ri 40,000 of corn, 50,000 of legumes, and 60,000 tons of fats. The imports cost all the apparent wealth brought in by export of oil, and still the people do not have enough to eat.

In 1943, when the United Nations delegates at Hot Springs assumed responsibility for raising the living and nutritional standards of these peoples, they were perhaps not fully aware of the scale or the complexity of what they had undertaken. It took some time to find out how hard it was going to be to establish a really effective policy for the Food and Agriculture Organization, the agency that they set up to attack the problem in its world-wide aspects.

In 1946, Lord Boyd Orr, then Director General of the F.A.O., submitted to the United Nations' governments a proposal to create a World Food Board "to provide financial and other technical arrangements necessary to convert human need into effective demand in the markets of the world". It was to be the duty of this organ to control the nutritional economy of the world; to promote stabilization of food prices; to buy and sell in the world markets, setting up food reserves and apportioning the surplus of given products to the areas that needed them most. Unfortunately, the proposal was never approved, and the F.A.O., for lack of specific powers, found itself limited to a kind of international consultative function, being, as Le Gros Clark put it, "a world brain on all matters concerned with the production, the distribution and the consumption of food and other products of soil, and the seas".

This limited operation of the F.A.O. has placed difficulties in the way of carrying out its mission, and new proposals have consequently been brought forward in an effort to strengthen its activity in the field of world economic policy.

The danger of overproduction relative to world consumer markets arose towards the end of 1948, and in June, 1949, the F.A.O. set up a Special Committee of experts to outline a general plan of action on a world scale. What worried the F.A.O. leaders was the discovery that following the economic splendour of American agriculture during the war and the first post-war years, farm prices had begun to fall in 1948, so that cash farm income was running 10 per cent less in 1949 than it had in the previous year. The Committee of Experts, which included such outstanding specialists as John Condliffe, Colin Clark, J. K. Galbraith, D. Ghosh, Gustave Polit and A. Randomysler, after considering all sides of the question, proposed the creation of an "International Commodity Clearing House", with the aim of controlling the purchase and distribution of foods. The technicians justified their proposal as follows:

> We make this proposal because of agricultural surpluses, a threat that need never materialize if action is prepared now while yet there is time. This action, to be effective, must be international. National governments are equipped with the means of regulating

> farm prices and productions; but national action is not enough. On the contrary, it can easily degenerate as it did in the 1930's into competitive dumping. Agricultural nationalism, experience has shown, can be more destructive than any other form of economic nationalism. What we propose is an international instrument of consultation and co-operative action in the commodity field, so that nations may join in concerted efforts to attack the common enemies of mankind—poverty, disease and hunger—instead of each attacking the other's prosperity in a futile effort to defend its own.

After citing the world's commercial unbalance, the Committee announced the necessity of carrying out an effective attack against this situation, and toward that end set out five different fields of struggle:

> There are five major fields in which an attack must be made. All are intricately connected and all are of vital importance. They do, however, have an appropriate time sequence and we list them in that order. The necessary measures are:
>
> (1) The maintenance of a high level of production and employment, particularly in the United States. In this case, as in others, the issue is not that the United States economy is less stable than that of other countries but rather that this economy is so critically important in that of the world.
>
> (2) The reduction of trade restrictions, including tariffs and quantitative and monetary restriction. In particular, the present dollar disequilibrium calls for measures to facilitate access to the United States market.
>
> (3) An increase in the standards of productive efficiency, particularly in countries of Western Europe.
>
> (4) The provision, by private enterprise and by national and international action, of large and continuing capital investments by the developed in the less developed areas of the world. This is necessary to finance the export surpluses of the former and the import surpluses of the latter.
>
> (5) The restoration of convertible currencies and multilateral transactions as the basis of world trade.

This plan of action might well have some effect if it is really orientated toward the living conditions and vital needs of the human groups that are underfed, and not treated merely as a temporary shot in the arm for overloaded export markets.

There can be no doubt whatever that one of the great drawbacks to this plan is its forced limitation to part of the world, and the impossibility of extending it to include the U.S.S.R. and the other countries that have been attracted into the economic orbit of the Soviet world. The ideal would be to seek an understanding in this field of vital human necessities, so as to permit a broad utilization of world resources, the economic integration of all nations, and an improvement in the living standards of humanity as a whole. When those responsible for the destinies of the two halves of the world come to realize that world problems can hardly be solved on the basis of closed economies, then perhaps an era of greater understanding and tolerance will open up for humanity, and co-operation may become possible on a truly universal scale.

One thing is certain—the best way to attain such co-operation is to reduce economic and social inequality by an adequate policy of development for the world's more backward areas. A world food policy, therefore, implies a sound policy of technical assistance to such areas, directed toward their genuine economic progress. Such technical assistance should not be limited to furnishing means and resources merely to enable them to produce more efficiently and more profitably the same raw materials which are now produced in colonial areas. England has already furnished this limited sort of technical assistance to various of her African colonies, and, far from improving nutritional conditions in those areas, has succeeded only in making them much worse. The technical assistance should be adjusted in accordance with the characteristics of each country, and should aim at the integrated development of its natural resources for the benefit of the people as a whole. Proper technical help would mean rational and scientific use of the soil; restoration of worn-out land; industrialization of local products; plans for electrification, irrigation, and transportation—in short, a whole complex of projects that would liberate these areas from economic colonialism. The application of technique "in suitable forms and in assimilable doses" as the Milbank Fund Study puts it, is capable of bringing about the economic liberation of such regions, and their transformation into zones of high productivity and full employment, within an expanding world economy.

2

It is quite possible to make the transition from a colonial economy to a co-operative world economy based on mutual interests without the imperialist or colonizing countries going bankrupt. Everything depends on the attitude of the colonizing powers toward the new world reality. As colonial areas develop into great consumer markets, they will be in a position to contribute substantially to the consolidation of a more balanced economy, by absorbing certain surplus products of more highly developed areas. The American Revolution, in freeing the thirteen British colonies, did not injure the English economy, but actually contributed greatly to its expansion. As soon as they were free, the former colonies became a prosperous market for British products, much ampler and more varied than the colonial market. "A growing U.S.," says Earl Parker Hanson, "did as much as India to create Britain's Victorian greatness."

Latin America, Africa, and the Far East constitute enormous potential markets which will begin to take their place in the world economy just as soon as their inhabitants, properly fed, can produce enough to reach a living standard in keeping with the technical possibilities of the modern age. Upon the improvement of living conditions in these areas now dominated by hunger and misery, therefore, depends the economic security and prosperity of the whole world. Under an economy of abundance, with adequate nutritional resources available to all human groups, a radical transformation will undoubtedly take place in the world's social structure. The Geography of Abundance will be matched by new social structures, which will guarantee the attainment of a new stage in the universal search for happiness and social well-being.

Two fundamental benefits will be achieved by seeing that everybody is well fed: the winning of health, and the winning of security—collective victories over sickness and fear. Those ailments, one physical and the other moral, are the two most degrading characteristics of our civilization.

I have already had occasion to demonstrate, in various chapters of this book, to what a terrible degree disease holds back the march of social progress. Its damage is equally significant in economic terms. The losses due to disease in the United States, for instance, are calculated by I. S. Falk at 10 billion dollars annually, and Balfour says the annual cost of sickness in England reaches some 185 billion pounds. These figures give some idea of the tremendous sums that ill health steals from the world economy. Now, it has been categorically demonstrated that a majority of the diseases to which humanity is exposed could be avoided, or at least greatly reduced in their incidence and effects, by an adequate diet. With freedom from hunger, human groups would also escape the oppression of fear, which often leads to attitudes that are incompatible with the dignity of human existence.

3

There are those who try to explain the decadence of our civilization and its inevitable downfall, as a progressive reduction in the number of individuals capable of bearing on their shoulders the enormous weight of our culture. This reduction is attributed to the biological and physiological decadence of man, to his lack of strength and courage to face social reality. But this weakness and this fear are, in great part, results of the hunger or threat of hunger to which many human groups in our time are exposed.

The fact is that many peoples, subjected to the dissolving action of hunger, surrender without a struggle to destructive and antisocial forces. We have seen how the siege of hunger delivered Japan over to Fascism. The same mechanism led to the triumph of Nazism in Europe during 1930–40. With many individuals lashed by hunger, and the threat of hunger creating a general panic, it was easy for the "hypnotists of the multitudes", as Keyserling calls the leaders, to knead the masses into a yielding dough. At that grave hour in history, certain European peoples felt themselves too weak to march forward with the dead weight of culture on their shoulders; they felt too weak to free themselves, by their own energies, from the moral asphyxia that surrounded them, and so surrendered to the urgings of the Fuehrers. Not knowing what to do with their hands, these poor slaves of misery gave in to the imperative gesture, and renouncing personality entirely, responded with the salute of submission. It expressed a voluntary loss of liberty, but it also gained them a momentary relief through flight from responsibility.

The collective psychosis that swept Europe at that time expressed a psychological crisis superimposed on a latent biological crisis. It was similar in many ways to a phenomenon observed by Pavlov in his experiments with conditioned reflexes in dogs. These animals could be so conditioned by the fear of hunger or of suffering that all their previous reflexes became entirely inhibited. The same thing happened to Europe, whose overwhelming anxiety complex has been well characterized by Pierre Janet in these words.

> Today the number of the depressed is enormous, individuals without sufficient energy to take an interest in public affairs, individuals in terror of social action. As a result they feel an overwhelming need for guidance and protection, and that is why dictatorships seem so attractive to them.

When Europe let itself be enslaved by the wave of Nazi-Fascism, it was giving way to an impulse to save its skin. "Its dirty hide," Curzio Malaparte calls it, symbolizing thereby the instincts that cry out imperiously from within the animal-man, particularly the instinct of hunger. "Before, one suffered, killed, and died to save one's soul. Today man suffers and makes others suffer, kills and is killed, does magnificent things and beastly things, merely in order to save his skin," says Malaparte, in a mocking, grotesquely tragic tone. This exaggerated love of one's own skin, this anguished impulse to satisfy the vegetable needs, derives from suffering, from fear, and from anguish provoked by the bitter experience of hunger. If society wants to recover its moral outlook, if it wants to see an increase in the number of men strong enough to fight, not only for their skins, but for a world of democratic principles worthy of human beings, then it must first of all eliminate completely the degrading pressure of hunger.

An economy of abundance will take humanity a great step forward toward the quantitative, as well as the qualitative, solution of population problems. People will not only become abler and healthier; they will be better adjusted, numerically, to their natural and cultural resources. Among those human groups which today seem most exposed to the dangers of overpopulation, there will quickly come about a reduction in the exaggerated indices of fertility, or as Vogt puts it, their uncontrolled reproductive appetite, and the curve of demographic growth will tend toward an equilibrium of population.

The road to world survival, therefore, does not lie in the neo-Malthusian prescriptions to eliminate surplus people, nor in birth control, but in the effort to make everybody on the face of the earth productive. Hunger and misery are not caused by the presence of too many people in the world, but rather, by having few to produce and many to feed. The neo-Malthusian doctrine of a dehumanized economy—which preaches that the weak and the sick should be left to die, which would help the starving to die more quickly, and which even goes to the extreme, in the formulations of Vogt, of suggesting that medical and sanitary resources should not be made available to the more miserable populations—such policies merely reflect the mean and egotistical sentiments of people living well, terrified by the disquieting presence of those who are living badly. To the mind of a Vogt, the world is a cocktail party for specially invited guests, not a mass celebration in the streets, where you are elbowed in the crush and have your toes stepped on. And so Vogt demands that the uninvited guests be thrown out, the kill-joys who upset the comfortable life of the past. Toward this salvation, he does not scruple to prescribe the most inhuman measures. In his fury to cleanse humanity he goes so far as to inveigh against doctors and modern medicine itself, because they have been trying to save lives by bringing preventive and curative methods to the more backward peoples. According to Vogt, these lives are undesirable.

The world, fortunately, will not let itself be carried away by such defeatist and disintegrative conceptions. In spite of their scientific aura, these ideas cannot show us a road to survival. They can only point the way to death, to revolution, and to war—the road to perdition. The real road to survival is still within the sight of man. It is marked by the confidence he must feel in his own strength. "Man's science is great but man himself is greater," writes E. P. Hanson, reaffirming for his contemporaries the faith we must hold in the stature of the human species.

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